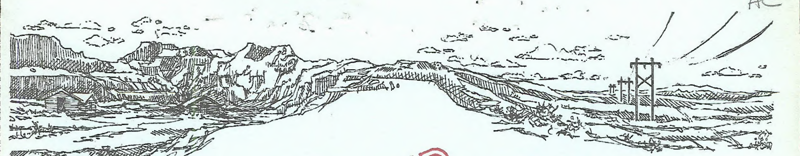
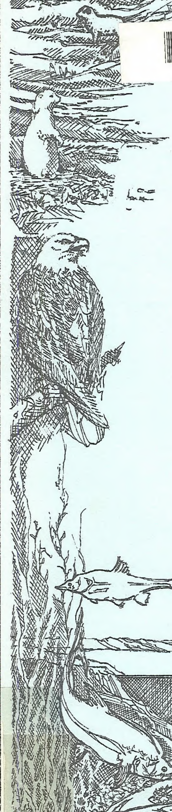




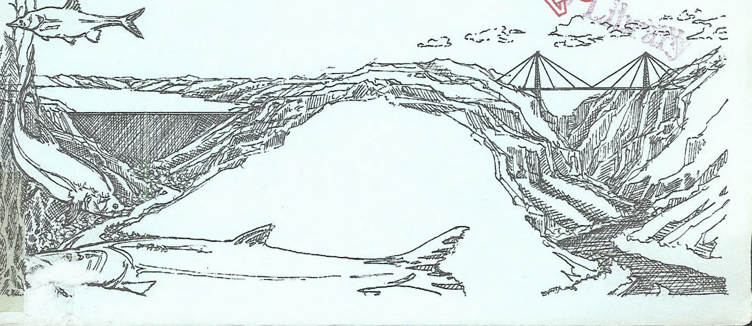
DRAFT

WHITE RIVER DAM PROJECT

ENVIRONMENTAL IMPACT STATEMENT

UNITED STATES DEPARTMENT OF THE INTERIOR

Bureau of Land Management



IN REPLY REFER TO
1792

United States Department of the Interior

BUREAU OF LAND MANAGEMENT
RICHFIELD DISTRICT OFFICE
150 East 900 North
Richfield, Utah 84701

Dear Reader:

Enclosed for your review and comment is the White River Dam Project Draft Environmental Impact Statement (EIS) prepared by the Bureau of Land Management, Richfield District Office.

Public Hearings on the Draft EIS have been scheduled in the following communities:

January 7, 1981
Room 128, Salt Palace
Salt Lake City, Utah
7:00 p.m.

January 8, 1981
District Court Room
Uintah County Courthouse
Vernal, Utah
7:00 p.m.

Comments on the Draft EIS may be submitted in writing or presented verbally at the public hearings. In order to be considered in the Final EIS, all comments must be received by February 10, 1981. Comments should be addressed to:

District Manager
Vernal District Office
Bureau of Land Management
170 S. 500 East
Vernal, Utah 84078

Written comments received by February 10, 1981, and testimony presented at the public hearings will be fully considered and evaluated in the Final EIS. Those comments that pertain to the adequacy of impact assessment or present new data will be addressed in the Final EIS.

Please retain your copy of this Draft EIS. Portions of this document will probably not be reprinted if changes in response to comments are minor.

Sincerely,

Donald L. Pendleton

District Manager

DEPARTMENT OF THE INTERIOR

DRAFT ENVIRONMENTAL IMPACT STATMENT

OF THE

WHITE RIVER DAM PROJECT

Prepared By

BUREAU OF LAND MANAGEMENT

DEPARTMENT OF THE INTERIOR

Gary J. Wicks

UTAH STATE DIRECTOR

WHITE RIVER DAM PROJECT
ENVIRONMENTAL IMPACT STATEMENT

(X) DRAFT ( ) FINAL

Lead Agency
U.S. Department of the Interior, Bureau of Land Management

Cooperating Agencies
U.S. Department of the Interior
Fish and Wildlife Service
Water and Power Resources Service
Geological Survey
U.S. Environmental Protection Agency
State of Utah
Office of the State Planning Coordinator
Utah Division of State History
Utah Division of Wildlife Resources
Utah Division of Water Resources
Utah Division of Parks and Recreation
Utah State Engineer
Uinta Basin Energy Council
Uintah County Commission

Abstract

This statement assesses the environmental consequences of five alternatives designed to supply water for energy development, including oil shale in Uintah County, Utah. The alternatives involve the Utah Division of Water Resources proposal (1) to construct the White River Dam and Reservoir; also, (2) No Action; (3) pumping from the White River and augmenting from Hell's Hole Canyon Dam; (4) pumping from Green River; (5) pumping from White River and supplementing with water pumped from the Green River.

The major environmental topics discussed are related to minerals, paleontology, soils, water, vegetation, wildlife, threatened and endangered plant and animal species, cultural resources, land use, and socioeconomics.

For further information regarding this statement or proposed alternative actions contact:

Mr. Lynn Leishman
Team Leader
Bureau of Land Management
150 East 900 North
Richfield, Utah 84701
Telephone (801) 896-8221
(FTS 584-8011)

Date by Which Comments on the Statement Must Be Received: February 10, 1981.

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SUMMARY

INTRODUCTION

The Utah Division of Water Resources filed a right-of-way application with the Bureau of Land Management (BLM) on August 4, 1975. The applicant proposes to utilize 3,560 acres of public land administered by the BLM to construct an earthen dam across the White River and create a 13.5-mile long reservoir with 1,860 surface acres. The reservoir would have an active storage capacity of 67,500 acre-feet and a sediment reserve capacity of 37,500 acre-feet, for a total of 105,000 acre-feet. Also proposed are a 5- to 8-MW hydroelectric plant, power transmission system, recreational facilities, and access roads. The proposed White River Dam Project would be located 40 miles southeast of Vernal, in Uintah County, Utah. The basic purpose of the project would be to supply water for energy development with potential users as follows:

The White River Shale Project sponsored jointly by three companies, Philips Petroleum Company, Sunoco Energy Development Company and the White River Shale Corporation, has an estimated water requirement of about 13,000 to 26,000 acre-feet per year at the 100,000 barrels-per-day oil production level. The companies' oil shale tracts of about 10,000 acres are on leased Federal land located adjacent to and south of the proposed White River Dam.

TOSCO Corporation also plans to develop about 14,000 acres of oil shale, leased from the State of Utah, with an estimated need of 18,000 acre-feet of water per year for commercial production. TOSCO's Sand Wash unit is located about 10 miles downstream from the proposed dam.

Other potential uses of White River Reservoir waters include 18,000 acre-feet per year as an alternative water supply for the proposed Moon Lake Power Plant which could be located near Bonanza, Utah, starting sometime in the 1980s. Also, a small quantity of water (4-5 cfs) would be withdrawn from the reservoir to replace Bonanza's existing supply for domestic use and gilsonite processing. In addition, water may be needed for other energy development projects, which may occur in this region of high oil shale and tar sand development potential.

Following the submission of the right-of-way application, the project proposals were explained to the public in accordance with Council on Environmental Quality regulations implementing the National Environmental Policy Act of 1969, as amended (NEPA).

A notice was published in the *Federal Register*, September 17, 1979 announcing the October 1979 public scoping meetings which were held at the BLM Vernal District Office and BLM State Office in Salt Lake City. Since these scoping meetings, numerous contacts have been made with Federal, State, local agencies and others to solicit their concerns and expertise.

Several issues and environmental concerns were identified by the various individuals and groups. Those of most significance are noted below:

Three species of rare endemic fish (Colorado squawfish, humpback chub, and bonytail chub) have been observed in portions of the White River in Utah and are officially listed as endangered. Other endangered species found within the region include the bald eagle, peregrine falcon, and Uinta Basin hookless cactus. Early in 1980, BLM requested consultation on these species with the US Fish and Wildlife Service (USFWS). The State of Utah requested on August 13, 1980, that BLM extend the Section 7 Consultation Period on this project required under the Endangered Species Act. Therefore, the USFWS has not yet provided a formal Biological Opinion regarding the impacts of the project on threatened and endangered species.

The Nation's energy situation relates to the White River Dam Project in several ways. There are strong views which indicate that increased energy production from oil shale and tar sands would significantly assist in reducing our dependency upon foreign oil while helping to satisfy regional needs. Water is required in the conversion processes of oil shale, electrical power generation, and other energy development projects.

The State of Utah wants to provide water for energy development by using a portion of its allocation under the conditions of the Upper Colorado River Compact.

Water has become an important issue in eastern Utah because of expanding needs, its limited availability, problems associated with water quality, and the potential impacts of cumulative water depletions to water-related ecosystems.

The Ute Indian Tribe of Fort Duchesne, Utah has prime water rights on the White River under the Winters Doctrine with a potential to irrigate 12,833 additional acres of undeveloped land.

Depletions of river flows along with water return from increased acreages of irrigated land cause concern over raised salinity concentrations in the

Green River and downstream into the Colorado River.

Current recreational and scenic uses of the White River in Utah are important to a small but growing number of users, particularily canoeists.

The loss of about 13.5 miles of river and the native aquatic ecosystem is considered important by a segment of the public; in contrast, other people express the view that the proposed dam and reservoir would be equally or more important.

In preparing this draft environmental impact statement (EIS), BLM has noted several interrelated projects which would contribute to cumulative impacts to the region and the upper Green River system.

The Deseret Generation and Transmission Cooperative proposes to construct a coal-fired steam electric power generating station (Moon Lake Project) to begin operation in the 1980s in either Utah or Colorado. Water supplies, approximately 18,000 acre-feet of water, would be needed annually from either the Green River or White River.

Other related projects on the upper Green River and its tributaries include the Juniper-Cross Mountain Dams on the Yampa River, Cheyenne Water Supply Project on the Little Snake River (a tributary of the Yampa), and the Central Utah Project on the Duchesne River system.

There is at present no specific compact between Colorado and Utah concerning the White River. Therefore, the allocation of water for emerging water consuming projects is not presently subject to any special interstate arrangement other than the overall provisions of the Colorado River Basin and Upper Colorado River Basin Compacts.

ALTERNATIVES

Several dam sites on the White River in Utah were investigated by the Utah Division of Water Resources utilizing a screening process, and then dropped from future consideration because the White River Dam site best met the state selection criteria, including engineering feasibility.

In response to NEPA, alternatives to the White River Dam Project have been identified and analyzed by BLM in this Draft EIS. The proposed White River Dam Project is identified as Alternative 1, and the other alternatives are as follows:

Alternative 2: No Action

This is a mandatory alternative required by NEPA. Under the alternative, BLM would not approve the use of Federal lands for the applicant's proposal or the other alternatives.

Alternative 3: Pumping From the White River and Augmenting From Hell's Hole Canyon Dam

The main water supply for energy development would be direct pumping of 70,000 acre-feet annually from the White River by individual developers in Utah during normal water years.

The project alternative would be the construction of the potential Hell's Hole Canyon Reservoir with a storage capacity of 25,000 acre-feet. This side canyon reservoir would be filled by pumping from the White River during high flows. During periods of low flows in the White River, releases would be made from the reservoir to augment natural flows in the river and thus provide a uniform supply of water for energy development projects. While releases from storage would be needed infrequently under present conditions, future potential water depletions from the White River in Colorado would increase the frequency of need for water releases from Hell's Hole Canyon Reservoir.

Alternative 4: Pumping Water From the Green River

This alternative would provide 70,000 acre-feet of water pumped continuously from the Green River to the vicinity of the proposed White River Dam site. Water would be released from Flaming Gorge Reservoir which would flow downstream about 120 miles to a diversion point near Walker Hollow, about 5 miles downstream from Jensen, Utah. A river pumping station, settling pond and sluiceway, two high lift pumping stations, and approximately 28 miles of buried pipeline would convey water for distribution to individual water users along the White River.

The Water and Power Resources Service has authority to contract for use of water from the Flaming Gorge Reservoir. This would be subject to negotiation according to information in the report entitled, "Alternative Sources of Water for Prototype Oil

Shale Development, Colorado and Utah, Bureau of Reclamation, Upper Colorado Region, Salt Lake City, Utah, September 1974."

Alternative 5: Pumping Water From the White River and Supplementing With Water Pumped From the Green River

The main supply of water, 70,000 acre-feet, would be pumped from the White River by individual water users during normal river flow years. The alternative project would be a pipeline similar to that in Alternative 4. During dry years, water would be released from Flaming Gorge Reservoir and pumped from the Green River to supplement White River flows. The main difference between Alternatives 4 and 5 would be the amount and frequency of pumping from the Green River.

ENVIRONMENTAL CONSEQUENCES OF THE PROPOSED ALTERNATIVE ACTIONS

Alternative 1: White River Dam and Reservoir

Oil shale would not be available during the life of the project on 1,860 acres inundated by the reservoir. A depletion of 67,000 acre-feet of water from the White River would result in an increase in salinity at Imperial Dam on the Colorado River of 3.4 mg/l.

The reservoir would inundate about 995 acres of riparian habitat, while another 4,575 acres of riparian vegetation, located downstream from the proposed dam, would be changed because of reduced river flows. Some wildlife would be displaced or lost, e.g., up to 176 beaver and 200 deer would be affected by the loss of habitat.

The native aquatic ecosystem would be lost within 13.5 miles of the river, while about 50 river miles of habitat would be altered below the dam. A partial loss of native fauna could occur in the lower 10-20 miles of the White River. Blockage of the White River channel and change in water quality would result in loss of habitat for the Colorado squawfish.

The cumulative loss of flows in the upper Green River basin due to this project along with other proposed water developments in the Green River system could adversely affect the continued existence of the Colorado squawfish.

The loss of stream canoeing opportunity would occur in the White River Canyon through the area which would be inundated.

Alternative 2: No Action

Current levels of management would be maintained for the Federal lands along the White River in Utah.

Oil shale developers would have to seek other water supply methods and processing might be delayed because of the lack of a reliable source of water in the vicinity of the proposed White River Dam Project.

Terrestrial and aquatic ecosystems would remain essentially undisturbed on the Federal lands along the White River Canyon in Utah, at least to the extent that they would not be impacted by water developments.

Demands for water are expected to expand because of the increased interest in synthetic fuels, including those derived from oil shale. Although advances in technology may continue to reduce quantities of water needed to process oil shale, there would still remain a need for water in the retorting processes, dust control, surface rehabilitation, and other activities.

Alternative No. 3: Pumping From the White River and Augmenting From Hell's Hole Canyon Dam

About 260 acres of oil shale would be inundated. The depletions of 70,000 acre-feet would cause salinity to increase 3.4 mg/l at Imperial Dam on the Colorado River. The cumulative loss of flows in the White River from this alternative and potential future projects upstream in Colorado could eliminate the White River as Colorado squawfish habitat; however, the depletions of water from the White River (70,000 acre-feet per year) by this alternative alone would not adversely impact the aquatic ecosystem along the White River.

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Cumulative impacts from this alternative and other proposed water developments in the Green River system could reduce flows sufficiently to adversely affect the continued existence of the Colorado squawfish.

Alternative No. 4: Pumping Water From the Green River

The Green River would be depleted by 70,000 acre-feet per year which would increase salinity at Imperial Dam by 3.4 mg/l.

The cumulative loss of water from this project and other proposed projects could adversely affect the continued existence of the Colorado squawfish. However, the adjustment in flows by compensating releases from Flaming Gorge Reservoir would avoid or minimize impacts to the squawfish through changes in river flows.

Alternative No. 5: Pumping Water From White River and Supplementing With Water Pumped From the Green River

In most years, sufficient water (70,000 acre-feet per year) would be pumped directly from the White River for energy development. Supplemental supplies of water from the Green River would be needed infrequently; perhaps only once in several decades. Environmental impacts would relate primarily to the overall effect of water depletion. Salinity would increase 3.4 mg/l at Imperial Dam on the Colorado River. The cumulative loss of water from this alternative, combined with depletions from future projects in the White River drainage could cause a change in the native ecosystem.

COST ESTIMATE AND ENERGY ANALYSIS

A very rough water supply cost comparison indicates that Alternative 1 (White River Dam and Reservoir) would be least expensive ($32 per acre-ft/yr) while Alternative 4 (Pumping From Green River) would be greatest ($118 per acre-ft/yr). Energy analysis shows that Alternative 1 and Alternative 3 (Hell's Hole Dam) would have the lowest energy requirements for construction (7×10^{11} Btus); however, Alternative 1 would be the only producer of energy during operation (9.9×10^{10} Btus per year).

UNRESOLVED ISSUES

Future allocations of water in the White River remain unresolved in several respects:

1. A proposed water compact between the State of Utah and the Ute Indians of the Uinta and Ouray Reservation has not been ratified by the Tribe. The Ute Indians, under the Winters Doctrine, are entitled to water for irrigation of land within the reservation. Water needed for 12,833 acres would be diverted from the White River.

2. The eventual consumptive use of water from the White River and its tributaries in Colorado has not been determined.

Both of the above water depletions could affect the future flows in the White River within Utah.

The habitat requirements and other biological needs of the Colorado squawfish are not fully known. The USFWS is continuing field studies along the White River to better understand the requirements of this endangered fish. Conclusions discussed in this Draft EIS reflect available information and professional judgement on a tentative basis; until the continuing studies and/or the USFWS formal Biological Opinion is issued.

Current assessments indicate that perhaps a single action such as the White River Dam Project would not seriously impact the region's aquatic ecosystem, including major adverse impacts to endangered native fish species. The major environmental concern appears to be the cumulative impacts of this project and others proposed within the upper Green River system.

CHAPTER 1

THE PURPOSE AND NEED OF THE PROPOSED ACTION

INTRODUCTION

In accordance with the National Environmental Policy Act of 1969 (Public Law 91-190, 1970), the Bureau of Land Management (BLM) has prepared this document in response to the filing of a right-of-way application by the Utah Division of Water Resources on August 4, 1975. The applicant proposes to utilize about 3,560 acres (1,441 ha) of public land administered by the BLM to construct an earthen dam across the White River which would create a reservoir. About 2,377 acres (962 ha) are within the project area while 1,183 acres (479 ha) are identified for dam core materials and are located north of Bonanza, Utah. Also proposed are a hydroelectric plant, power transmission system, recreational facilities, and access roads. The proposed White River Dam Project would be located about 40 miles (64 km) southeast of Vernal, in Uintah County, Utah (Figure 1-1).

This chapter explains the purpose and need of the proposed project, the scoping processes that were used to identify significant environmental issues and concerns of people, and interrelated projects which could have cumulative effects. Government actions required to authorize the project are in Appendix 1. Appendix 2 contains an English-metric conversion table for units used in this environmental impact statement (EIS).

PURPOSE AND NEED OF PROPOSED PROJECT

The basic purpose of the proposed White River Dam Project would be to supply water for energy development, principally related to oil shale development.

The White River Shale Project is developing about 10,000 acres (4,047 ha) of oil shale on two tracts leased from the BLM. These two tracts, designated as Ua and Ub, are located adjacent to and south of the proposed dam. Three companies, Phillips Petroleum Company, Sunoco Energy Development Company, and White River Shale Corporation, have joined together for the purpose of establishing and implementing a plan for the combined development of the tracts. These companies have estimated a water requirement of about 13,000 to 26,000 acre-feet per year at the 100,000 barrels-per-day oil production level.

The White River Oil Shale Project's detailed development plan contains the following variables related to water use:

1. There is a wide variation in water required for cooling, dust suppression, and compaction of the processed shale resulting from the various retorting systems. The actual water use for these purposes would depend on the final selected retorting system and operating experience.

2. Regardless of the selected retorting system, the water requirements shown for an acceptable degree of dust control and shale compaction are only estimates and could well be higher. There is a substantial tradeoff between water use and energy production in the design of the cooling system for the plant.

TOSCO Corporation also plans to develop about 14,000 acres (5,666 ha) of oil shale with an estimated need for 18,000 acre-feet of water per year for commercial production. Their Sand Wash unit is located about 10 miles (16 km) downstream from the proposed White River Dam.

The Ute Indians have a right to annually divert water from the White River in Utah (Winters Doctrine) to irrigate lands near Ouray, Utah (refer to Appendix 3). This entitlement has been estimated to be 61,598 acre-feet per year in order to irrigate 12,833 acres of land. A recent economic study of the Ute Indian Irrigation Project suggested that irrigation of Ute lands would not be economically feasible and that the Ute Tribe may consider selling or leasing a portion of their water rights for industrial use (McKee 1978).

Other potential uses of White River Reservoir waters include 18,000 acre-feet per year as an alternative water source to supply needs of the proposed Moon Lake Power Plant which could be located near Bonanza, Utah, starting sometime in 1986. A small quantity of water (4 to 5 cubic feet per second (cfs)) would also be withdrawn from the reservoir for Bonanza's domestic and gilsonite processing uses under this proposal.

In addition to the above known water requirements, additional water may be needed for other oil shale development in Utah (Paraho, Geokinetics), as well as tar sand development south of the White River.

In conjunction with the White River Dam, a 5- to 8-megawatt (MW) hydroelectric power plant is pro-

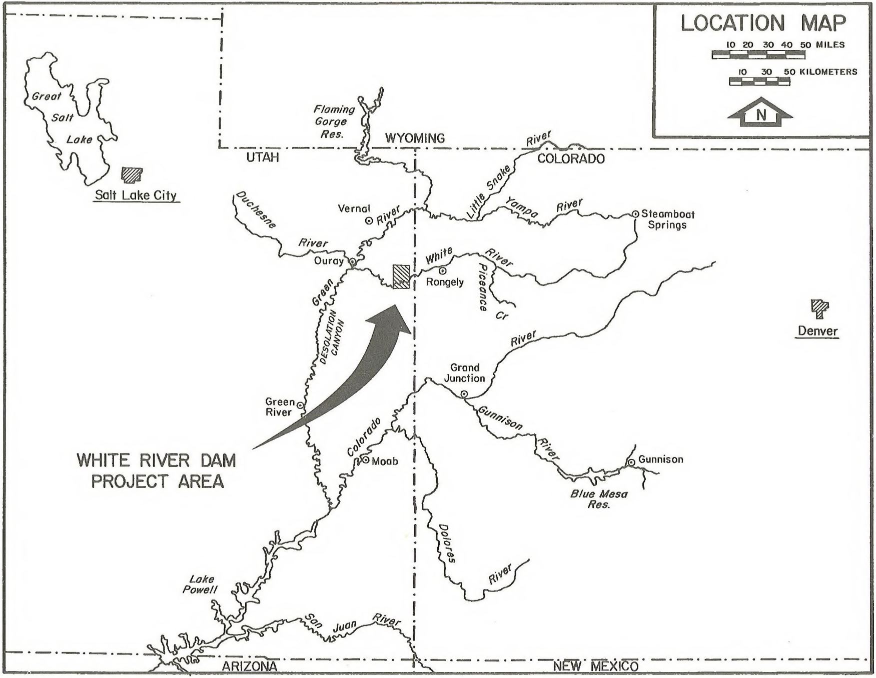

Figure 1-1
WHITE RIVER DAM PROJECT AREA REGIONAL LOCATION MAP

posed. It would generate an estimated 29 million kilowatt hours (KWH) on an average annual basis. The plant would most likely be constructed by the State of Utah after the dam is completed and operated by the State of Utah and/or a private electric utility company.

In addition, the 13.5-mile-long (17.6-km-long) reservoir and tailwaters of the dam would provide several forms of recreational opportunities not presently available in this portion of Utah along the White River.

SCOPING PROCESS

Notice was published in the *Federal Register*, Volume 44 No. 181, September 17, 1979, announcing the schedule of public meetings to identify the significant issues and alternatives to be analyzed in the EIS concerning this project.

Public meetings were held on October 17, 1979, in the BLM Vernal District Office and October 18, 1979, in the BLM Utah State Office, Salt Lake City, Utah.

Since these formal scoping meetings, numerous contacts have been made with Federal, State, local agencies, and others to solicit their concerns and expertise (e.g., Federal Energy Regulatory Commission, US Corps of Engineers, Water and Power Resources Service, US Fish and Wildlife Service, Environmental Protection Agency, Utah State Division of Wildlife Resources, Utah Division of Parks and Recreation, Utah State Historic Preservation Officer, Uintah County Commissioners, environmental groups, and individuals).

Numerous issues were identified in the scoping process. A summary of the more significant ones is provided below:

Threatened, Endangered, and Sensitive Species

Three species of rare endemic fish, Colorado squawfish, humpback chub, and bonytail chub, have been observed in portions of the White River and are officially listed as endangered. Other officially listed threatened and endangered species found within the region include the bald eagle, peregrine falcon, and Uinta Basin hookless cactus. The State of Utah requested on August 13, 1980, that BLM extend the Section 7 consultation period required under the Endangered Species Act on this project. Therefore, the US Fish and Wildlife Service (USFWS) has not yet provided a formal Biological Opinion on the impacts of the proposed project on threatened and endangered species. The reason for the extension is that the USFWS will be conducting fishery studies on the White River during the next year. These studies should help clarify the importance of the White River to Colorado squawfish and the other endangered fishes.

Energy Development

The Nation's energy situation relates to the White River Dam Project in several ways. There are strong regional (western United States) and state views that increased energy development would serve regional-national energy needs and that water to support such development is essential. The proposed water development project or alternatives could be important in support of accelerated energy development in the oil shale region of eastern Utah.

Local Socioeconomics

It is estimated that 50 to 100 workers would be needed to construct the White River Dam and associated facilities including the hydroelectric plant. Preliminary projections indicate that workers would live in existing communities and commute to the job rather than live near the project site. Questions raised include: What is the current capability of affected towns and counties to provide the goods and services needed by the project workers and their families? What changes, if any, are anticipated in terms of local socioeconomic conditions, i.e., quality of life and economic conditions?

Water

The State of Utah has an objective to develop a part of its Colorado River Compact water allocation on the White River primarily for energy development services. This is an important issue due to growing needs for water, limited availability, problems associated with water quality, potential changes in ground and surface water, and cumulative impacts of water uses and its relationship to ecosystems.

In May 1965, the State Division of Water Resources filed to appropriate 250,000 acre-feet from the White River and tributaries for the purpose of mining, drilling, and retorting oil shale and other energy-related projects, i.e., hydroelectric power generation. A water supply has been identified for the processing of oil shale by the White River Oil Shale Project, TOSCO, Paraho, and Geokinetics. The Ute Indian Tribe of Fort Duchesne, Utah, has prime rights on the White River with a potential to irrigate several thousand additional acres of undeveloped land. Added withdrawal of surface water and return flows from irrigated lands are expected to increase salinity concentrations in the Green River.

Recreation

Current recreational uses of the White River in Utah include: limited fishing for catfish; hunting for deer, coyote, waterfowl, and upland game birds; and recreational boating including canoeing, particularly during the high flows of early summer. Scenic and primitive values and opportunities for solitude are experienced by some. Access roads provide limited opportunities for camping near the river.

Other Issues

The impacts of the White River Reservoir on future oil shale processing near the proposed reservoir concerned some people, particularly the potential seepage of water from the reservoir into oil shale bearing formations.

Also of concern were cultural and paleontological values that might be affected by project construction activities and inundation by the reservoir.

The White River and adjacent river bottoms supply water, forage, and other needs for wildlife and domestic livestock. The riparian vegetation zones are an essential part of these ecosystems.

The loss of a native desert aquatic ecosystem is considered important by some, likewise the creation of a recreational fishery is also considered important by others. The Colorado River basin has been greatly altered in the last 75 years. Most of the major tributaries are altered by dams or diversions. The White River, along with the Yampa River, are the only unregulated tributaries of any size remaining in the upper Colorado basin. This would suggest the loss of the White River ecosystem is a significant ecological loss that has considerable scientific as well as aesthetic value.

A historic site, Ignatio Stage Stop, with its remaining rustic buildings would be inundated by the reservoir.

Exploratory oil drill holes located near the White River currently ooze thick crude oil and could be a pollution problem if not properly capped.

Some suggested that the analysis of project needs and alternatives address the issue of water use technology by improved processes that could decrease the amount of water development required in the area. The issue of sedimentation and its effects on reservoir life were also suggested for thorough analysis.

INTERRELATED PROJECTS

Interrelated projects in various stages of planning are important to the assessment of regional and cumulative impacts. They are briefly noted here.

The Deseret Generation and Transmission Cooperative (Deseret) is composed of six rural electric cooperatives serving owner customers in Utah and contiguous areas of Wyoming, Colorado, Arizona, and Nevada. Deseret proposes to construct a coal-fired steam electric power generating station (Moon Lake Project) to begin operation in the 1980s. Two generating sites are currently under study. One site is located near Bonanza, Utah, and the other north of Rangely in western Colorado.

Water sources probably would be either the White River or Green River supplying a need for 17,000 to 18,000 acre-feet of water annually. A separate EIS is being prepared for this project by BLM.

Two sites within the White River drainage in western Colorado are being investigated by Water Users Association No. 1 of the Colorado River Water Conservancy District for water storage and use for the proposed alternative Moon Lake Rangely power generating station. One site is located near the mouth of Taylor Draw, while the other is located near the confluence of Wolf Creek and the White River.

Other related projects on the upper Green River and its tributaries include the Juniper-Cross Mountain Dams on the Yampa River, the Cheyenne Water Supply Project on Little Snake River, a tributary of the Yampa, and the Central Utah Project on the Duchesne River system. Other water projects have been listed for future development in the upper Green River system. Separate EIS's will be prepared for these interrelated projects. The uncertainties of locations, schedules, and the lack of definite information discourages further discussion in this EIS of future interrelated water projects.

CHAPTER 2

DESCRIPTION OF ALTERNATIVES

INTRODUCTION

This chapter describes the proposed alternatives for supplying water for oil shale and other development near the White River in Uintah County, Utah (Figure 2-1). The alternatives are:

1. The White River Dam and Reservoir;

2. No action;

3. Pumping from the White River and augmenting with water stored behind Hell's Hole Canyon Dam;

4. Pumping water from the Green River; and

5. Pumping water from the White River and supplementing with water pumped from the Green River.

The White River Dam Project is the proposed alternative of the State of Utah. Other alternatives were developed through the scoping process initiated in 1979 by BLM. The description of these alternatives is based on reconnaissance level studies by the U.S. Bureau of Reclamation (USBR) (1974) (note: USBR changed to Water and Power Resources Service, WPRS, in 1979) and by BLM and their consultant, BIO/WEST, Inc., who prepared the Draft EIS.

Western rivers, such as the White River, have large amounts of water flowing in them during average water years. However, most of the water flows during spring runoff, and the flow of the rivers becomes very low in late summer and fall. Also, during drought conditions, rivers such as the White River are reduced considerably in volume during all months of the year. Therefore, storage of water in a reservoir to supply development demands during low flow periods is a requirement of most Western water development.

The White River Dam Project was proposed to meet a storage requirement identified by the Utah Division of Water Resources for the White River. During development of other alternatives for this EIS, storage was a prime consideration. Storage for Alternatives 4 and 5 would come from Flaming Gorge Reservoir, a large, existing reservoir on the Green River (Figure 1-1). Storage for Alternative 3 would come from a 25,000 acre-foot reservoir in Hell's Hole Canyon, a side canyon to the White River.

In describing and analyzing the proposed project and alternatives, BLM recognizes two important conditions:

1. The physical and environmental parameters are based on historical and/or current conditions. This is particularly relevant with respect to White River flows and identified water uses in Colorado and Utah. This means that the proposed project and alternatives are described as they would be operated with historical and/or current river hydrology, as a "first-added" new development of water resources.

2. Future events in the upper Colorado River basin, including tributaries such as the White River, could markedly alter parts of the descriptions of the alternatives related to river flows, storage frequencies, sediment loads, and similar system-related items. Although potential future developments are identified in concept, specific quantification of such future events is speculative and essentially impossible to do accurately at this time.

The White River Dam EIS is based on the best information available, quantified to the extent now possible from empirical records and from interpretation of real data. Even so, some assumptions have been necessary and are so stated in the document. Quantification of future consumptive use of water from the White River upstream in Colorado (i.e., upstream from the proposed White River Dam Project) has not been done in this EIS.

Two principal criteria were set up for the development of reasonable alternatives to the proposed White River Dam. First, the alternatives would develop 70,000 acre-feet of water per year. Second, the water would be delivered to a point on the White River in the vicinity of the White River Dam. The 70,000 acre-foot figure was used because the White River Dam and Reservoir could provide 67,500 acre-feet of water for known users (White River Shale Project, 26,000 acre-feet; TOSCO, 18,000 acre-feet; Moon Lake, 18,000 acre-feet; evaporation, 5,500 acre-feet), and that figure was rounded out to 70,000 acre-feet for the other alternatives. This figure (70,000 acre-feet) converts to a constant flow rate of 97 cfs.

U.S. Geological Survey (USGS) Watson gauge data from the White River, the main water source for Alternatives 1, 3, and 5, indicate that water could be taken directly from the river by constantly pumping 97 cfs in all but 1 year out of the last 50 years. This includes leaving 250 cfs in the river at

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all times for downstream water users (see Appendix 3). But during the worst case year, 1977, 39,000 acre-feet of storage would have been required to supply a total need of 70,000 acre-feet. This was calculated by utilizing instream water from the White River when flows exceeded 250 cfs, but requiring storage water when flows were lower than 347 cfs. When natural flows were lower than 250 cfs, the entire 97 cfs was obtained from storage, and no instream water was utilized.

The storage capacity of Hell's Hole Canyon Reservoir would be approximately 25,000 acre-feet. During periods of extreme drought conditions, this would not be sufficient to maintain the full 70,000 acre-foot per year water requirement. This alternative should, therefore, be considered a partial alternative. Based on topography it would be possible to construct a dam in Hell's Hole Canyon to provide 70,000 acre-feet of reservoir capacity. However, this dam would be in excess of 400 feet (122 m) high and it is doubtful that the project would be economical. Therefore, only the partial alternative was considered.

All of the other alternatives meet the 70,000 acre-foot requirement in "worst case" situations as both the White River Dam and Flaming Gorge Dam would have sufficient storage.

Other alternative means of supplying water were briefly screened for consideration. Several dam sites on the White River were reviewed by Bingham Engineering (1976), consultants to the State of Utah, but rejected as being less feasible than the proposed site. The USBR (1974) also reviewed several sites and conducted a reconnaissance level study on a dam site near the upper end of the proposed White River Reservoir called the Watson site. This alternative was eliminated from consideration in this EIS because it would back water into Colorado, a situation unacceptable to the State of Utah, and because a dam at the Watson site appeared to offer no environmental advantages over the applicant's proposed site.

The groundwater supply in the vicinity of the Utah Oil Shale Tracts has been studied by VTN Colorado, Inc. (1975 and 1977), an environmental consulting firm from Denver, Colorado, and the USBR (1974). Most investigations thus far have been restricted to the areas of Oil Shale Tracts Ua and Ub, but it can be assumed that groundwater characteristics are relatively consistent across the study area. Approximately 80,000 acre-feet of groundwater is thought to be held in storage in the Bird's Nest Aquifer (VTN Colorado, Inc. 1977). The recharge characteristics of the aquifer are not well known, but production of water from the aquifer is considered to be minimal (VTN Colorado, Inc. 1977). Water in the Bird's Nest Aquifer, located from 0 to 1,000 feet (0-305 m) below the surface, is unsuitable for domestic, commercial, or agricultural purposes (VTN Colorado, Inc. 1977) because of water quality. Although the quality varies with locations, it averages 3,000 milligrams per liter (mg/l) total dissolved solids (TDS) and is commonly charged with hydrogen sulfide gas.

The Douglas Creek Member of the Green River Formation lies 900 to 1,000 feet (274-305 m) below the Bird's Nest Aquifer and is a potentially usable aquifer (Austin and Skogerboe 1970). Water quality taken from several flowing wells averages about 900 mg/l in TDS (VTN Colorado, Inc. 1977). The member appears to contain a reasonable amount of fair quality water, but has a maximum transmissivity capability of only 1,500 gallons/day/foot (Phillips 1980). In order to produce enough water to support oil shale operations, 20-30 wells scattered over several thousand acres would be required to avoid pumping effects of one well upon another (Phillips 1980).

Therefore, this EIS does not cover a groundwater alternative in detail. Additional studies on the groundwater supply of the project area would be required to clarify the amount of water available. It is possible that groundwater could be used to augment water pumped from the White or Green Rivers. Groundwater could also supply some of the smaller water users projected for the region.

It is possible that a dam on Evacuation Creek, another White River side canyon, would provide water storage, up to 65,000 acre-feet, in much the same manner as the Hell's Hole Canyon Dam. The environmental impact of this dam would be similar to the Hell's Hole Canyon Dam, with some site specific differences. Preliminary investigations into this reservoir site indicated water leakage through the Bird's Nest Aquifer was possible, and the site was located over a major portion of Utah Oil Shale Tract Ub. Therefore, due to uncertainties regarding water holding capabilities and the potential loss of oil shale mining capability, Evacuation Creek was not considered a viable alternative.

ALTERNATIVE 1: WHITE RIVER DAM AND RESERVOIR

Location and General Description

The White River Dam Project components would include:

1. An earth and rockfill dam and reservoir;

2. A hydroelectric power plant;
3. A power transmission system;
4. Recreational facilities; and
5. Access roads.

The proposed dam would be located in eastern Utah about 40 miles (64 km) southeast of Vernal, Utah, in Section 17, Township 10 South, Range 24 East (Figure 2-1). The dam would be a 129-foot-high (39 m) zoned earth and rockfill structure as shown by the typical dam cross section in Figure 2-2. An outlet works, service spillway, auxiliary spillway, and a hydroelectric power plant would be constructed at the dam site, at the approximate locations shown on the general layout plan in Figure 2-3. Figure 2-4 is a visual simulation of the proposed dam and reservoir.

Embankment and Foundation

The dam embankment would consist of an inner core constructed of the most impervious materials from the borrow areas, an outer shell constructed from sand and gravel materials, and a rockfill constructed from material from required rock excavation (Figure 2-2). Some select materials for internal drains, filter material, and transition zones could also be required. A cutoff trench extending to bedrock would be required to prevent excessive seepage through the sand and gravel deposits that presently overlay much of the dam site. This cut-off trench would extend the full length of the dam. Sand-cement grout would be used to seal cracks in the bedrock if they were found to exist. Riprap (large boulders, 1 to 3 feet in diameter, 0.3 to 1.0 m) would be placed on the upstream slope to prevent damage from wave action.

Reservoir

The proposed White River Dam Project would create a reservoir with a storage capacity of 105,000 acre-feet (67,500 active and 37,500 inactive). At maximum capacity elevation, 5,015 feet (1,522 m), the reservoir would produce a body of water approximately 13.5 miles (22 km) long with a maximum width of 0.7 miles (1.12 km) (Figure 2-5). About 1,890 surface acres (765 ha) would be inundated when the reservoir is filled to capacity. At the minimum water surface elevation of 4,969 feet (1,514 m), the reservoir surface would be approximately 1,115 acres (451 ha) and would extend 6.5 miles (10.4 km) upstream from the dam. Maximum depth of the reservoir from streambed to service spillway crest would be 119 feet (36 m). The area-capacity curves for the reservoir are shown in Figure 2-6.

Most vegetation would be left intact below the permanent reservoir level. Only vegetation in the fluctuation zone (46 feet) (14 m) of the reservoir would be removed and burned or buried, as would dead falls below the permanent pool level.

Outlet Works

The outlet works would consist of a 6- to 10-foot diameter (1.8 to 2.4 m) penstock (water supply pipe to the power generating turbines), a 36-inch diameter (91.4 cm) bypass pipe, and an intake structure. The penstock and bypass pipe would be encased in reinforced concrete, as shown in Figure 2-7, and would be supported on undisturbed bedrock. The intake for the outlet pipes would consist of a tower and four gated openings. The Utah Division of Water Resources has indicated a willingness to operate the reservoir to minimize the effects of water temperatures within the capabilities of the dam's design. There would be at least two gates in the outlet works; however, final design has not been determined. The gates would provide for emergency closure to enable inspection and maintenance of the pipes. The bypass outlet would be utilized to maintain downstream irrigation releases if the power plant were to be shut down.

Spillways

SERVICE SPILLWAY

The service spillway would be a reinforced concrete structure on the left (south) abutment (Figure 2-3) with an uncontrolled overflow crest elevation of 5,015 feet (1,528 m) and a capacity of 6,000 to 8,000 cfs. This capacity would be sufficient to pass a 100-year flood. The service spillway would discharge into a stilling basin energy dissipator near stream level below the dam. Normally, there would be up to 2,300 cfs of flow in the spillway during May and June of each year and no flow in the remaining months.

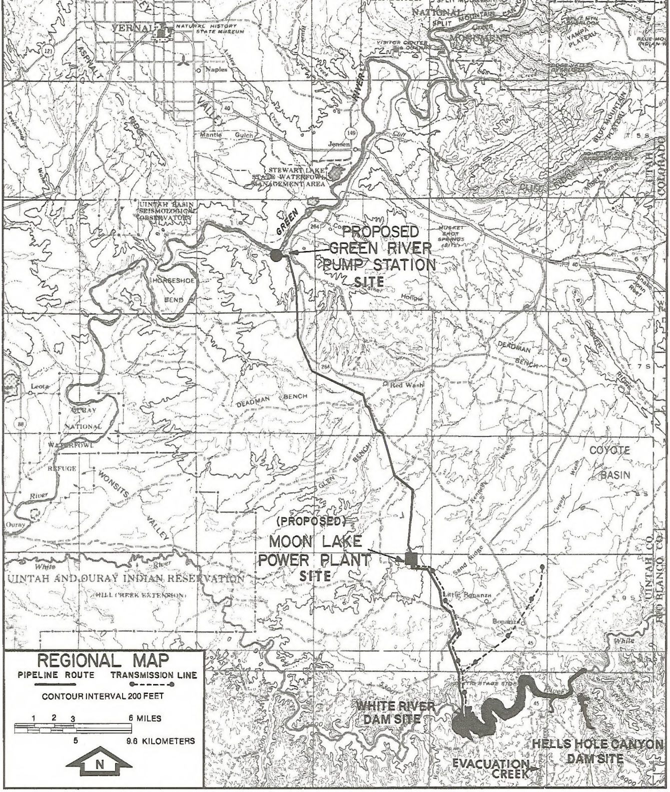

Figure 2-1
REGIONAL MAP FOR THE WHITE RIVER DAM PROJECT AND ALTERNATIVES

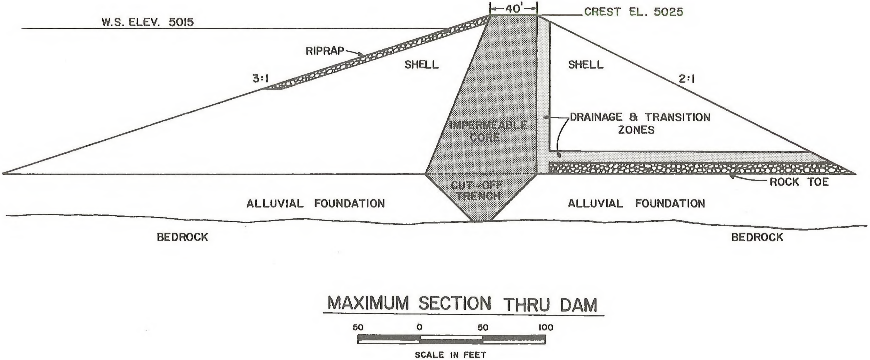

Figure 2-2
TYPICAL SECTION THROUGH THE WHITE RIVER DAM
Source: Utah Division of Water Resources (1979)

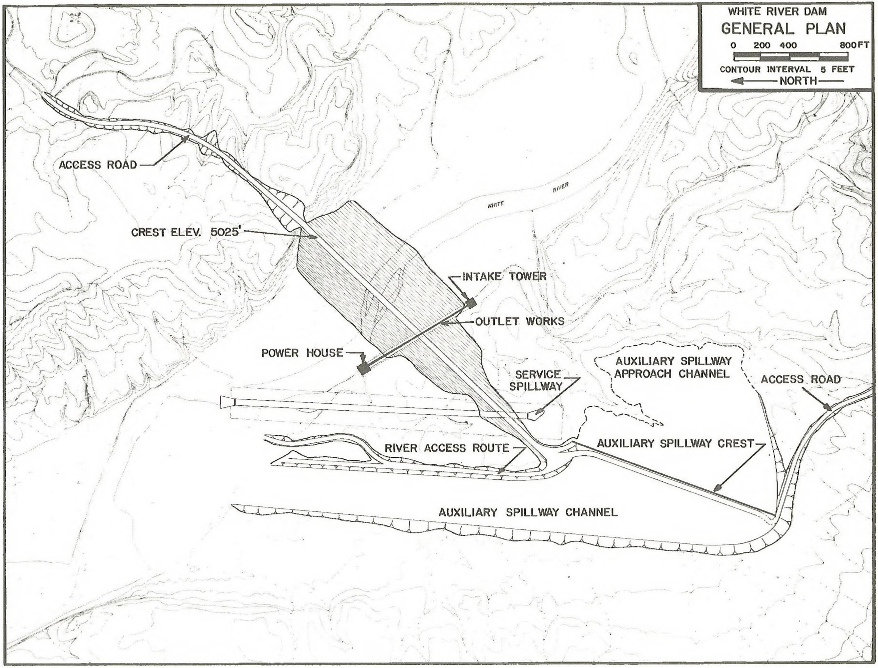

Figure 2-3
GENERAL LAYOUT PLAN FOR THE WHITE RIVER DAM
Source: Bingham Engineering

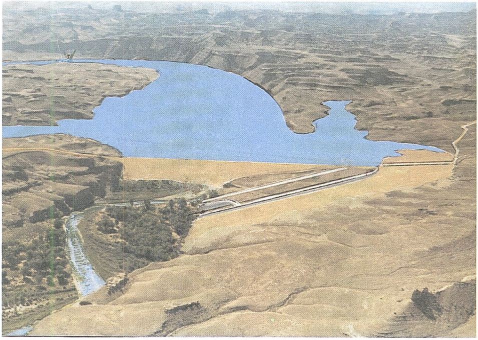

Figure 2-4
VISUAL SIMULATION OF PROPOSED WHITE RIVER DAM AND RESERVOIR

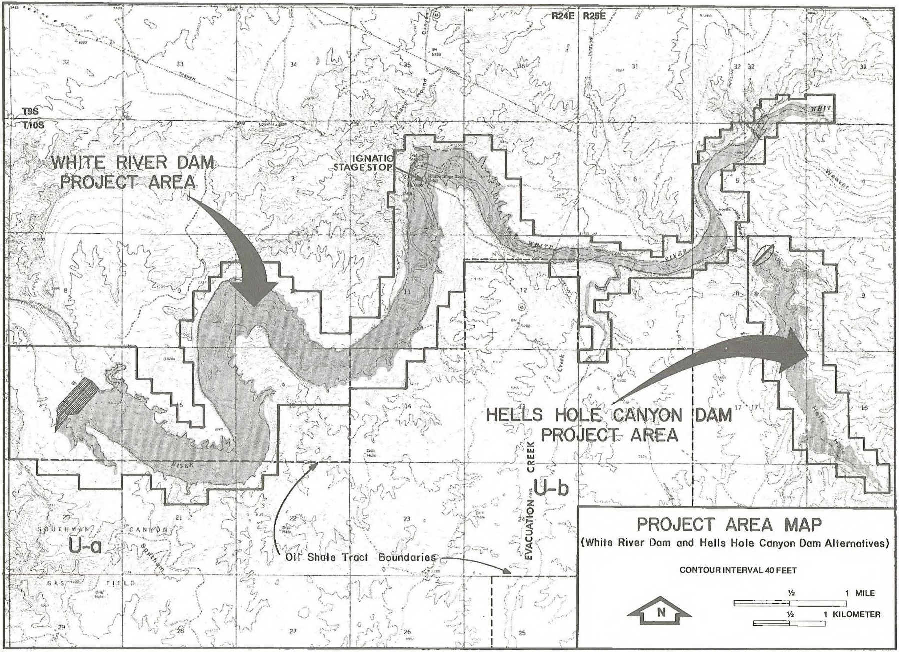

Figure 2-5

PROJECT AREA FOR WHITE RIVER RESERVOIR AND HELL'S HOLE CANYON RESERVOIR

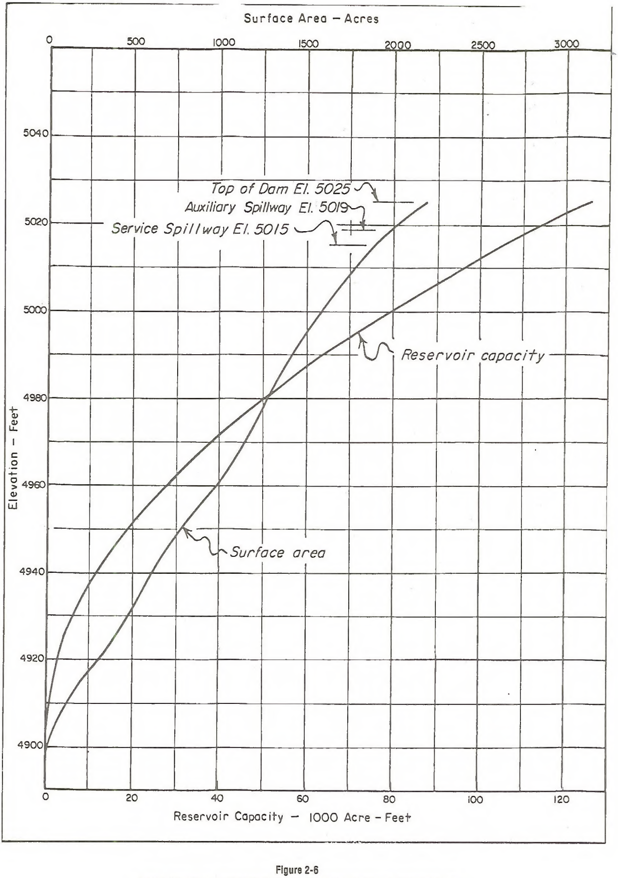

Figure 2-6

AREA CAPACITY CURVES FOR THE WHITE RIVER RESERVOIR

Source: Utah Division of Water Resources (1979)

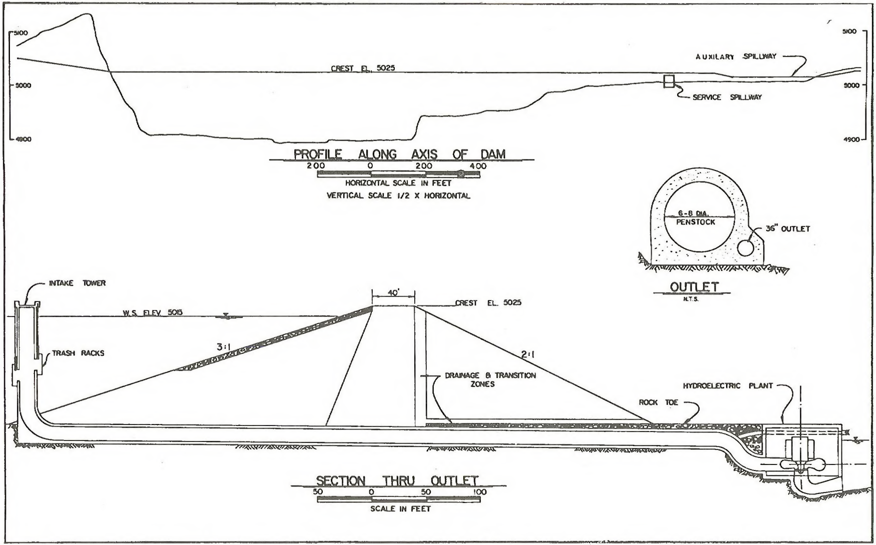

Figure 2-7

PROFILE ALONG AXIS, AND SECTION THROUGH OUTLET WORKS, OF THE WHITE RIVER DAM

Source: Utah Division of Water Resources (1979)

AUXILIARY SPILLWAY

An auxiliary spillway located on the extreme end of the left (south) abutment would be designed to accommodate flows between 70,000 and 75,000 cfs. The crest of the auxiliary spillway would be at an elevation of 5,019 feet (1,529 m) and would have a length of between 1,000 to 1,500 feet (300-450 m). A road would be located across the crest of the spillway as shown in Figure 2-3. The existing natural draw (into which flood flows from the auxiliary spillway would discharge) would be enlarged and graded. It is expected that this spillway would never be used, but would be provided in case of an extreme flood emergency in order to provide for the structural safety of the dam.

Material Sources

Approximately 2,000,000 cubic yards (1,529,200 m^3) of material would be needed to construct the various zones of the dam embankment. Most of the material would be obtained from the excavation for the auxiliary spillway, shown in Figure 2-3.

The rock generated by excavation for the access road, outlet works, and power house would also be incorporated into the embankment as rockfill and riprap. It is anticipated that as much as 250,000 cubic yards (191,150 m^3) of rockfill would be generated due to this excavation.

In addition to the above on-site borrow areas, several off-site borrow areas would be used to provide material for the embankment and inner core. These areas are shown in Figure 2-8. Altogether, approximately 350,000 cubic yards (267,610 m^3) of core material could be required from these sites for construction.

Two sources are being considered for sand and gravel required for concrete aggregate: terrace deposits upstream from the dam and a commercial source near Jensen, Utah. In either case, the material would have to be processed to satisfy concrete aggregate requirements.

Construction

Dam construction would require about 2 years and from 15 to 50 workers. Figure 2-9 shows the projected construction schedule. Excavations and embankment operations would require about 20 workers. About 50 workers would be required during a 6-month period for concrete forming and placing. It is expected that construction workers would come from local communities and would commute to the site.

The outlet works would probably be one of the first features of the dam to be constructed. A cofferdam (temporary barrier) across the river upstream from the proposed dam would be constructed to divert the river through an unlined canal to the outlet works during construction of the cutoff trench.

Excavation of the cutoff trench would require an extensive dewatering system to keep the bottom of the trench dry. The water pumped from the dewatering system would be discharged into the river.

A concrete batch plant would probably be constructed near the site to supply concrete for the construction of the spillway, outlet works, and power house. The specific location of the batch plant would be determined by the contractor, but would be situated within the project area.

Reservoir Operation

The White River produces an average annual discharge of approximately 503,000 acre-feet (based on 50 years of data) and the reservoir with initial filling would store 105,000 acre-feet. Therefore, no problem is expected in filling the reservoir and maintaining a substantial outflow through the dam. Current operating plans developed by the Utah Division of Water Resources call for maintaining a consistent outflow release of 200 to 1,200 cfs (see Appendix 3) which would be sufficient for power production requirements as well as minimum downstream flow requirements. However, the potential does exist for lower flows for short periods of time to meet emergency operational requirements. During low flow periods, when flows in the White River at the head of the reservoir are lower than 250 cfs, the natural flow of the river would be released, plus any stored water necessary to meet downstream requirements of TOSCO (25 cfs).

A computer simulation of anticipated reservoir operations has been completed by the Utah Division of Water Resources for the 48-year period from 1931 to 1978. The simulation provides information pertinent to the reservoir as to:

1. Whether the active capacity is sufficient to meet all potential demands of the river under project conditions;

2. The drawdown required;

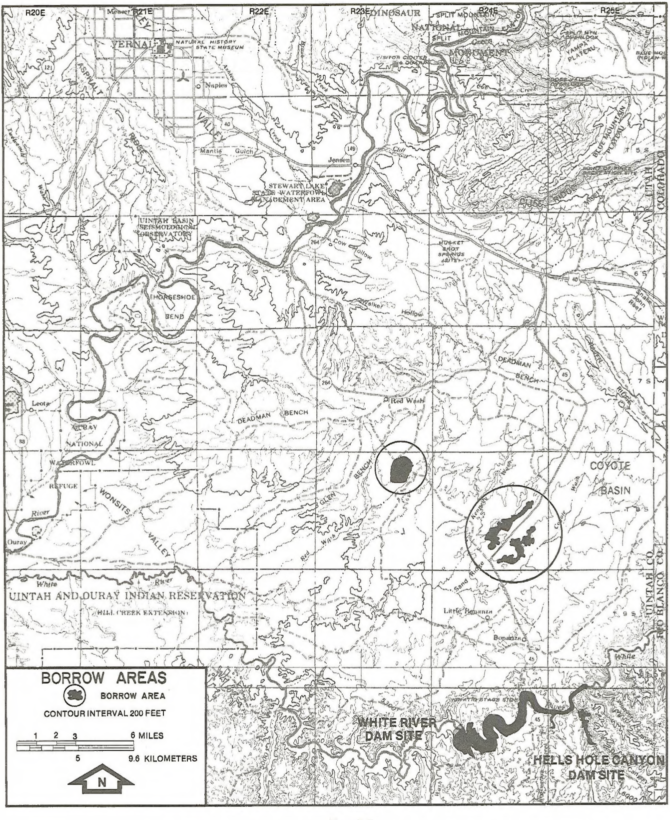

Figure 2-8
BORROW AREAS AWAY FROM THE DAM CONSTRUCTION ZONE

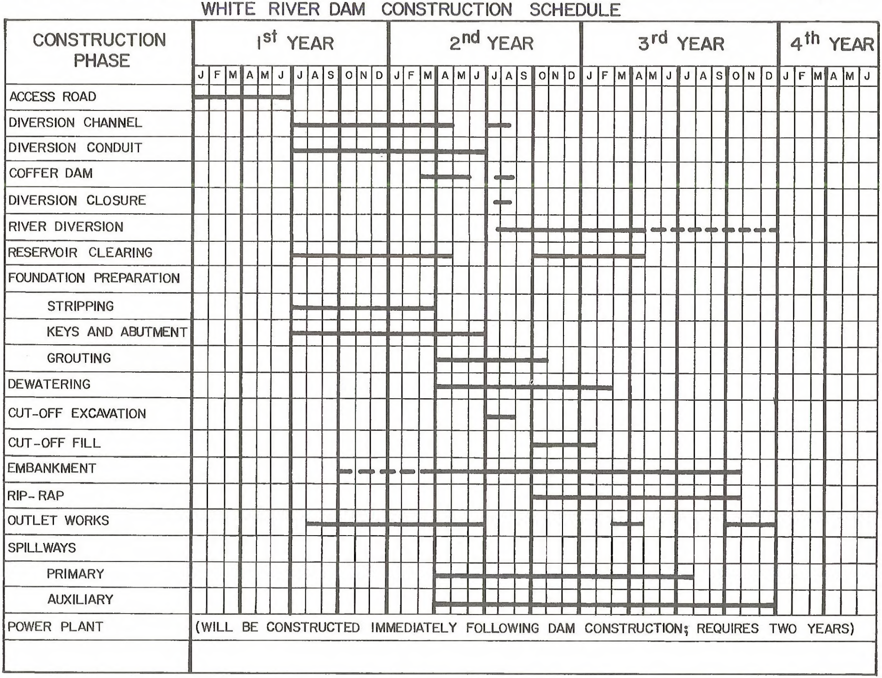

Figure 2-9
WHITE RIVER DAM CONSTRUCTION SCHEDULE
Source: Utah Division of Water Resources (1979)

3. The maximum and minimum releases for power generation within acceptable limits of the turbine;

4. Resulting spills.

Results of the simulation are available in a report prepared by the Utah Division of Water Resources (1980a).

Reservoir operating levels are expected to range between 5,006 and 5,015 feet (1,525 and 1,528 m) of elevation under normal conditions, potentially reaching extremes of 4,980 to 5,025 feet (1,517 and 1,531 m) in worst-case situations. The 100-year flood is estimated at 6,000 to 8,000 cfs, which would be reduced approximately 2,000 cfs by the reservoir's flood routing effects. The 100-year flood could be readily handled by the service spillway. The auxiliary spillway, designed for larger floods, would have a capacity of 70,000 to 75,000 cfs.

The reservoir would have a total storage capacity of 105,000 acre-feet, of which 7,000 acre-feet would be dead storage (below the outlet) and 31,000 acre-feet would be reserved for sediment and fish conservation. The reservoir could be drawn down 46 feet (14 m) before reaching the inactive storage level, although this drop is not anticipated under foreseeable operating policy. The outlet works would be designed to withdraw water from between 4,920 and 4,950 feet (1,499 and 1,508 m) of elevation.

An interagency group analyzed the sediment accumulation of the reservoir. They assumed a 94-percent trap efficiency based upon studies of other similar reservoirs. Grenney and Kraszewski (1980) analyzed all available sediment and flow data and, using the technique of Hawkins (1980) and the data of Grenney and Kraszewski (1980), determined that the average sediment input in the reservoir was 1,273 acre-feet per year. If no mainstream dams are constructed in Colorado on the White River, this amount would fill the available sediment storage space (the inactive storage of 37,500 acre-feet) in approximately 33 years and the entire reservoir in 82 years. There are no plans for eventual dredging or construction of a sluice to remove sediment from the proposed reservoir.

Hydroelectric Power Plant

A 5- to 8-MW capacity hydro-plant would be constructed near the downstream toe of the dam at the approximate location shown in Figure 2-3. The plant would generate an estimated 29 million KWH on an average annual basis.

The power plant would be built by the Utah Division of Water Resources or by an electrical utility under agreement with the State of Utah. It would be built immediately following construction of the dam and would require 15 to 20 workers for a period of 2 years.

The power plant would be designed to produce power from releases of 200 cfs minimum to 1,200 cfs maximum under a maximum head of 111 feet (33.8 m) and a minimum head of 66 feet (20.1 m).

Power Transmission System

A 138-kilovolt (kV) power transmission line would extend from the hydroelectric plant to the proposed Moon Lake Bonanza power plant site which would be located in Section 35, Township 8 South, Range 22 East, at the approximate location shown in Figure 2-1. The route would be about 10.5 miles (17 km) long and 60 feet (18 m) wide and require approximately 77 acres (31 ha) of right-of-way. The H-Frame towers would consist of two wooden poles approximately 55 to 60 feet (16.8 to 18 m) high and spaced 13.5 feet (4 m) apart. A 28-foot (8.5 m) timber cross arm would span the two poles and support the power transmission lines about 50 feet (15 m) above the ground. The towers would be spaced generally 650 to 700 feet (198 to 213 m) apart. Figure 2-10 shows a similar transmission line in Uintah County, Utah.

An alternate power line route, shown in Figure 2-1, would be followed if the Moon Lake Power Plant were not constructed at the Bonanza site. The alternate power line would terminate at an existing Moon Lake Electric power line located within Section 12, Township 9 South, Range 25 East, northeast of Bonanza,. Utah. It would be about 10.1 miles (16 km) long and 60 feet (18 m) wide, using about 74 acres (30 ha).

A substation would be located near the dam site. It would require a 75-foot by 100-foot (22.8-m by 30-m) parcel of land. The exact location of the substation has not yet been determined.

Access Roads

US Highway 40 and Utah State Highway 45 currently provide all-weather access from Vernal to Bonanza. Straightening and relocation of the existing county roads from Bonanza to the dam site and to the upper reservoir area would provide access to

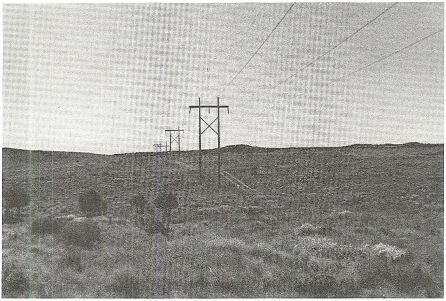

Figure 2-10
PHOTOGRAPH OF AN H—FRAME TOWER TRANSMISSION LINE IN UINTAH COUNTY, UTAH

both ends of the proposed reservoir. These routes would be 22-foot-wide (6.7-m-wide) gravel roads.

Two routes are being considered for improvement as access to the dam site, one from the north and one from the south. The north route has two alternatives to be considered: the existing unimproved road that extends from the Bonanza-Ouray highway to the White River near the dam site (Alternative A) and the existing unimproved BLM road from the Wagon Hound Canyon road to the dam site (Alternative B) (Figure 2-11). A short section of heavy rock excavation would be required on Alternative A at the approximate location circled in Figure 2-11. Both of these routes utilize the same road for about the last 4 miles (6.4 km). The exact alignments of the proposed alternatives have not been set. Generally, the roads would be located within 250 feet (76 m) on either side of the center lines of the existing roads. The only exceptions would be with Alternative A in the areas requiring heavy rock excavation and the common alignment as it approaches the crest of the dam. Considerable rock excavation would be required to construct an approach for the access road to cross the dam as shown in Figure 2-3. The south access road (Alternative C) would be located as shown in Figure 2-11 and would require about 1 mile (1.6 km) of new construction before connecting with an existing road to Southam Canyon.

Two alternatives are being considered for maintaining traffic across the White River at the upper end of the reservoir. Alternative D would use the existing Wagon Hound Canyon road at Ignatio Stage Stop and would require raising the grade above the high water level created by the proposed White River Dam (Figure 2-11). A new bridge would replace the old one at Ignatio. Approach fills for the bridge would be placed into the proposed reservoir as shown in Figure 2-12 and would provide a road width of 28 feet (8.5 m). A 600-foot-long (183 m) and 34-foot-wide (10.4 m) bridge would then span the reservoir. Embankment material for the approach fills would be obtained from the excavation for the straightening of the road in Wagon Hound Canyon and from the material site shown in Figure 2-7.

Alternative E would be located approximately 3 miles (4.8 km) upstream from Ignatio Stage Stop as shown in Figure 2-11 (Alternative E). This route would leave the existing road at Bonanza and return to it approximately 1.5 miles (2.4 km) south of the White River. New road construction would cover approximately 6 miles (9.6 km) following, at one point, approximately 1 mile (1.6 km) of an existing gravel road. The river crossing would be a bridge 1,300 feet long (396 m) spanning a chasm of approximately 370 feet (113 m) (Figure 2-13).

Recreation

The recreation potential of the proposed White River Reservoir and tailwater has been appraised by the Utah State Division of Parks and Recreation (1980). That agency suggests the significance of the recreational aspects of the dam would depend heavily on the quality of the fishery. Therefore, it recommends a three phase development plan. Phase I would include one boat ramp near Ignatio with a parking lot and toilets, and river access below the dam for fishing and river running (Figure 2-14). Phases II and III would include additional camping and parking spaces at Ignatio and a boat ramp and campground near the dam as visitation pressures increase (Figure 2-14). Phases II and III would be instituted as the need arose. Figure 2-15 is an aerial photograph of the Ignatio area.

Applicant-Proposed Mitigative Measures

REVEGETATION

It is anticipated that most of the borrow materials would be removed from areas excavated for project features (auxiliary spillway, access roads, etc.). The borrow areas outside the project area would be shaped to drain and blend in with the surrounding topography. They would also be seeded with natural cover to prevent erosion. The auxiliary spillway would also be shaped and blended into the surrounding topography and, except in bedrock areas, planted for erosion control.

FISHERY FACILITIES

The need for fish screens on the facilities in the reservoir area is not anticipated. Intake velocities through the trashracks for the outlet works and for any future pumping facilities would normally be maintained at less than 2 feet (0.6 m) per second. Velocities only a few feet away from the intake areas would be negligible, and fish would be able to escape from them easily.

The discharge from the reservoir outlet works into the river below the dam would be through a cone dispersing valve. These valves would discharge a conical spray of water into the atmosphere creating a high degree of aeration as well as energy dissipation. This method of discharge con-

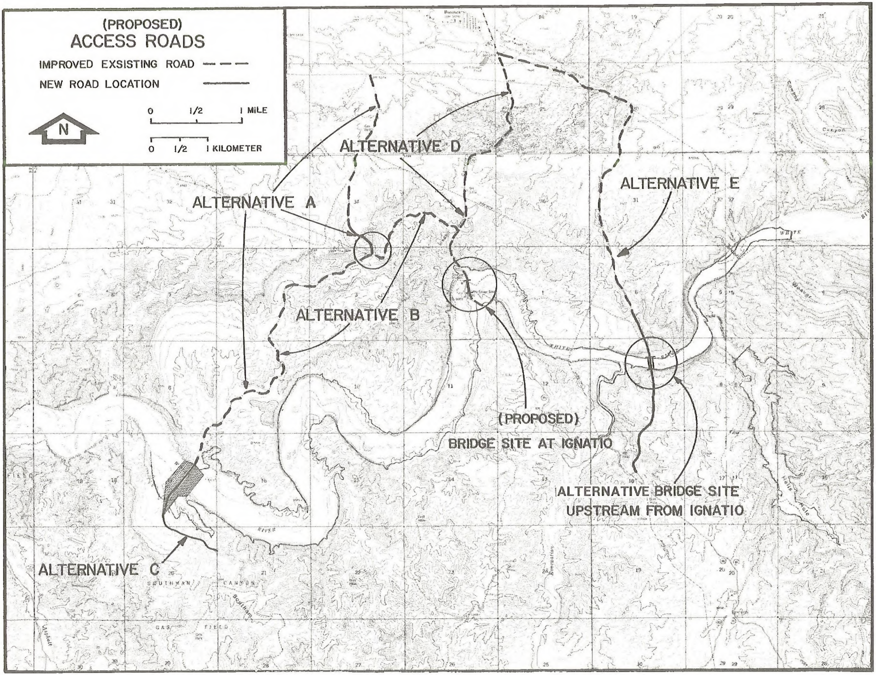

Figure 2-11
ACCESS ROADS ASSOCIATED WITH THE WHITE RIVER DAM PROJECT
Source: Utah Department of Transportation

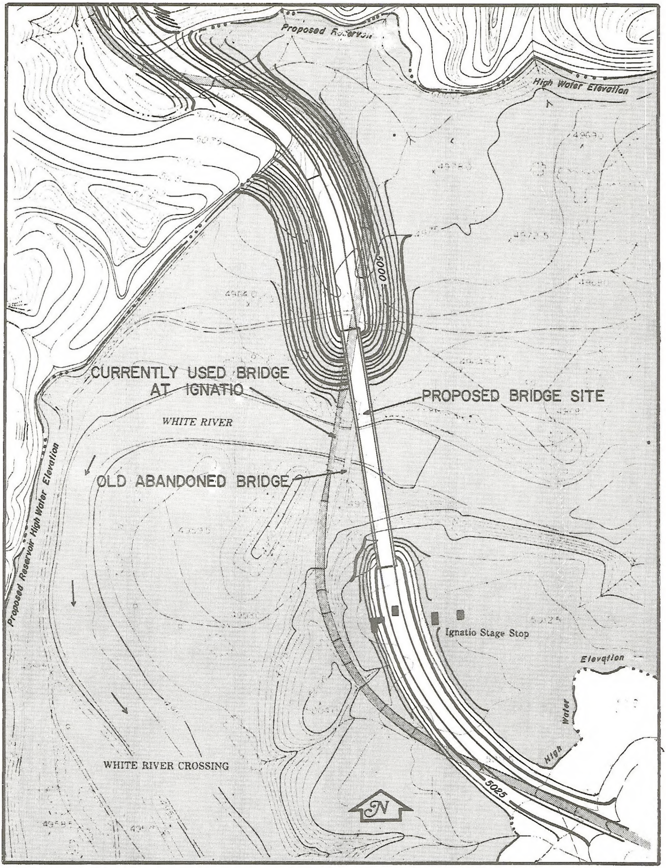

Figure 2-12

PROPOSED ABUTMENT AND BRIDGE ACROSS THE WHITE RIVER RESERVOIR AT IGNATIO

Source: Utah Department of Transportation

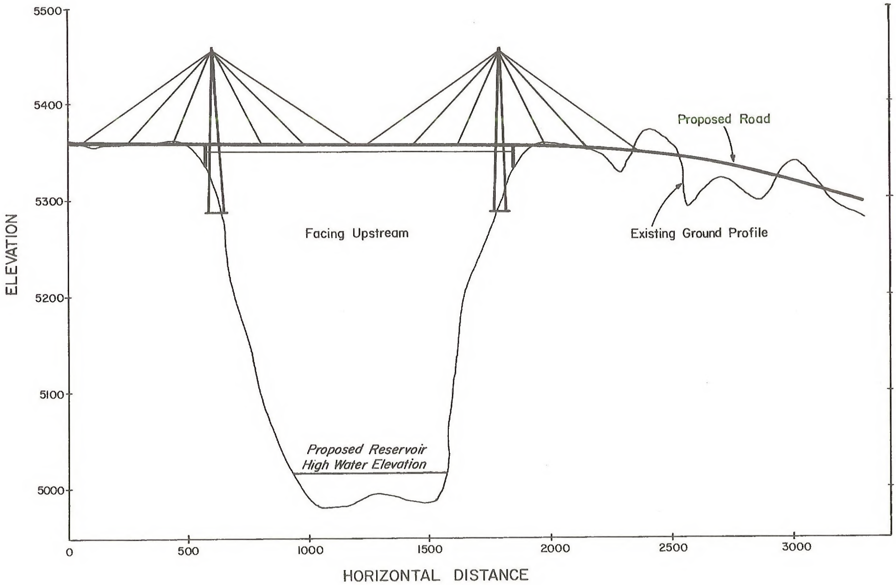

Figure 2-13
ALTERNATIVE BRIDGE ACROSS WHITE RIVER, ACCESS ROAD, ALTERNATIVE E
Source: Utah Department of Transportation

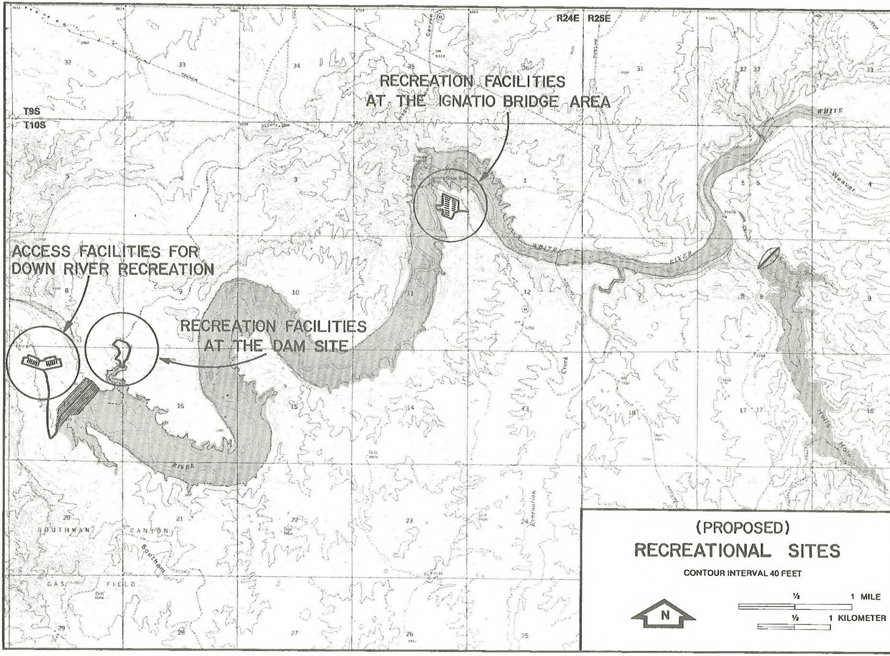

Figure 2-14

PROPOSED RECREATIONAL SITES ASSOCIATED WITH THE WHITE RIVER DAM AND RESERVOIR

Source: Utah Division of Water Resources (1979)

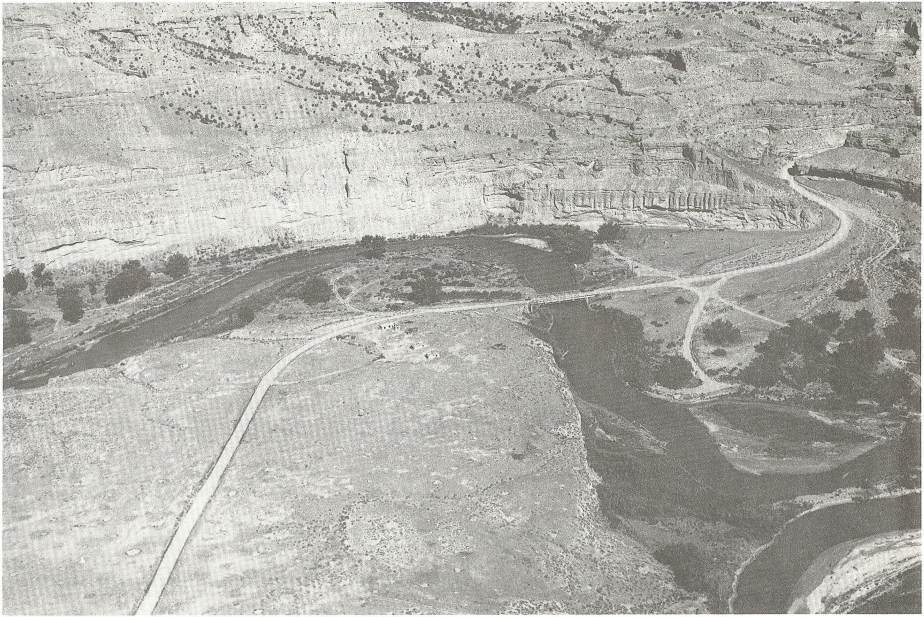

Figure 2-15
AERIAL VIEW OF IGNATIO AREA

trol should help increase dissolved oxygen to optimum levels for fish survival downstream below the dam.

FUGITIVE DUST CONTROL

Dust is not expected to be a problem during construction of the project. The borrow areas and embankment would be kept moist to achieve desired compaction and would not be subject to dust formation. Haul roads would be sprinkled at regular intervals to keep dust to an acceptable level.

OIL-TAR SEEPS

One oil-tar seep located within Section 17, Township 10 South, Range 24 East in the reservoir near the dam site (Figure 2-16) would be inundated. This seep would be plugged prior to filling the reservoir.

EFFECTIVENESS OF APPLICANT-PROPOSED MITIGATIVE MEASURES

The application of the mitigating measures described here, as well as others to be required by BLM, are discussed further in Chapter 4. The effectiveness of the mitigating measures is considered there as they are applied in the impact analysis.

Comparative Cost

A very rough cost estimate was made to compare alternatives. The annual cost per acre-foot of water utilizing Alternative 1 for the White River Dam would be $32 (see Appendix 4).

ALTERNATIVE 2: NO ACTION

This alternative would constitute no BLM approval of the right-of-way applications for the Utah Division of Water Resources to use Federal lands for the proposed reservoir project. In addition to no approval of Alternative 1 (White River Dam), it means that Alternatives 3, 4, and 5 would not be selected. The No Action Alternative could be applied for a short time or a long, indefinite period.

Under the No Action Alternative, the current level of development and patterns of management would be maintained, especially as related to BLM-administered land in the affected area. No permanent water diversion facilities would be built for oil shale development at this time.

The present trends in the Uinta Basin indicate continued and increased development of energy resources, greater need for water (even though technological advances may tend to reduce volumes of water needed for energy development), and increased population growth and its associated cultural impact. At the same time, there is an increased awareness and appreciation for wildland values throughout the United States, as evidenced by protective legislation on both the State and Federal levels.

The No Action Alternative would be intended to avoid major commitments of resources at this time in order that conflicts between energy needs and environmental values (especially endangered fishes) can be further studied. It would be intended to accommodate further definition (or firming up) of actual energy-related water demands as oil shale technology develops, as well as additional definition of possible interrelated projects in the upper Colorado River basin. It would be intended to preserve present options available in resource management and decision-making.

Chapter 3 describes the existing environment of the White River area. The intent would be to maintain its present environmental status under the No Action Alternative.

Although the No Action Alternative is required in this EIS in accordance with regulations of the Council on Environmental Quality and the National Environmental Policy Act, it is considered to be a real alternative with utility for meeting the objectives (at least in part) as noted above.

ALTERNATIVE 3: PUMPING FROM THE WHITE RIVER AND AUGMENTING FROM HELL'S HOLE CANYON DAM

Location and General Description

The main water supply for this alternative would be direct pumping from the White River. Individual diversions and pumping stations along the White River required by the various developers will not be discussed here but would require separate environ-

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Figure 2-16
OIL TAR SEEP NEAR DAM SITE

mental analyses. During years of normal flow, the entire 97 cfs (70,000 acre-feet) would be pumped directly from the White River. This would allow for a minimum flow of 250 cfs in the river to account for downstream needs (see Appendix 3).

When natural flows in the White River, Utah are less than quantities needed (97 cfs), then releases from the Hell's Hole Canyon Reservoir into the White River would be made. This would augment water supplies needed for energy development projects, i.e., White River Shale Project, TOSCO, and others.

Based on historical record, studies show that water from the Hell's Hole Canyon Reservoir would be needed infrequently, perhaps only 1 year in 50. However, future increased depletions from the White River in Colorado would increase the frequency of need for water from Hell's Hole Canyon Reservoir.

The Hell's Hole Canyon Dam would consist of an earth-filled dam constructed across Hell's Hole Canyon within Section 8, Township 10 South, Range 25 East (Figure 2-5). The dam site is located about 4 miles (6.4 km) southeast of Bonanza, Utah, in Uintah County. Figure 2-17 is a visual simulation of the proposed Hell's Hole Canyon Dam and Reservoir. The purpose of the dam would be to provide a 25,000 acre-foot reservoir to augment the water supply in the White River. As previously mentioned, this would be a partial alternative because during drought conditions (1977) more than 25,000 acre-feet of storage would be required.

The USBR conducted a reconnaissance level study on the feasibility of constructing a dam in Hell's Hole Canyon (USBR, 1974). No borings were made to determine subsurface conditions and only a reconnaissance level geologic study was conducted.

Hell's Hole Canyon Dam would be constructed near the canyon's intersection with the White River (Figure 2-5). A 300-cfs capacity outlet works and a 1,000-cfs spillway would be constructed as appurtenant structures to the dam. The location and details of these structures have not been established.

The reservoir would be filled by pumping water from the White River and conveying it through a 0.5-mile-long (0.8 km) welded steel pipeline having a diameter of 54 inches (137 cm). This would require a 138-cfs pumping plant, a diversion structure and intake channel, and an off-stream settling pond and sluiceway for return of sediment to the river. The diversion structure would not extend across the White River.

Embankment and Foundation

The Hell's Hole Canyon Dam would be a zoned earth structure approximately 294 feet (90 m) high. An upstream slope of 3:1 and a downstream slope of 2:1 were used in the cost analysis. The embankment volume would be approximately 4,450,000 cubic yards (3,402,470 m^3). A cutoff trench extending to bedrock would extend the full length of the dam. Since subsurface information at this site is not available the required depth of the trench is not known, but it would probably not exceed 25 to 30 feet (7.6 to 9 m). Riprap would be used on the upstream slope to prevent damage from wave action.

Reservoir

The reservoir would inundate about 260 acres (105 ha) at a normal water surface elevation of approximately 5,340 feet (1,627 m), as shown in Figure 2-5. The maximum water surface elevation would be 5,358 feet (1,632 m). The reservoir would have a total capacity of 25,000 acre-feet. No dead or inactive storage would be provided. It is unlikely that the reservoir would provide important recreational facilities or suitable fisheries habitat.

Water would be pumped into the reservoir during periods of high flow. The reservoir would then act as a regulatory system with intermittent releases to the White River for energy development projects.

Since the water would be pumped into the reservoir from a settling pond, no silt accumulation is anticipated.

Flood Design

Although it was found that the normal flows from the Hell's Hole Canyon would make a negligible contribution to the water supply, a spillway would still be necessary to provide for an estimated 5,500 acre-feet to protect against possible floods. A small emergency spillway would be included; however, an analysis of probable maximum flood from the drainage area above the reservoir must be completed to determine the spillway size.

Figure 2-17
VISUAL SIMULATION OF HELL'S HOLE DAM AND RESERVOIR SHOWING DIVERSION WORKS AND PUMPING FACILITIES

Water Diversion and Pumping Facilities

A diversion structure and intake channel and a pumping station would be provided on the river. Since the sediment content of the river is high at the diversion point, a settling pond and sluiceway for return of sediment to the river would also be provided. The details of these facilities were not established in the reconnaissance level study conducted for this alternative. For purposes of this EIS, however, it was assumed that these facilities would have a permanent impact for a distance of about 0.33 mile (.5 km) along the river.

A buried pipeline would start at the pumping station and extend up the floor of Hell's Hole Canyon approximately 0.5 mile (.8 km) to the base of the dam. It would be encased in concrete and pass under the dam into the reservoir. The section under the dam would probably use the outlet works pipe.

Material Sources

Approximately 4,450,000 cubic yards (3,402,470 m^3) of fill material would be required to construct the various zones of the embankment. The specific source of the fill material was not determined during the Hell's Hole Canyon reconnaissance study. Some of the material could come from the access road excavation. If sufficient borrow material were not available in the reservoir area it would be necessary to import material from other locations. The other borrow areas would probably be farther up Hell's Hole Canyon (south of the reservoir).

A supply of concrete aggregate for construction of the spillway, outlet works, diversion structure, settlement pond, sluiceway, and pumping station would be required. This aggregate would probably be imported from a commercial gravel pit (such as the one near Jensen, Utah).

Construction Activities

The construction of Hell's Hole Canyon Dam would require about 2 years and from 20 to 60 workers. Twenty to forty workers would probably be required during the major portion of the construction phase of the project. Construction workers would probably be local and commute to the site.

Since the Hell's Hole Canyon Dam would be a side-canyon dam, water diversion during construction would be a simple process. The depth to the groundwater table is not known but it is unlikely that dewatering would be required during construction of the cutoff trench.

Access Roads and Power Line

All-weather access would be required to the dam site. Although specific access road alignments have not been decided, Utah State Highway 45 through Ignatio Stage Stop would provide the most likely access to the dam. From Utah 45, the existing unimproved road starting in Section 20 and extending north through Sections 17 and 8 would be improved. About 3 miles of road construction would be required in the vicinity of the dam to provide access to the pump station and diversion structure at the base of the dam.

New construction and considerable excavation would be required to build the road down to the dam. The road would then be routed down the face of the dam to reach the pipeline and pumping station areas.

Power to run the pumps would be brought in from an existing line at Ignatio. The power line would follow Highway 45 and the access road to the dam site.

Comparative Cost

A very rough cost estimate was made to compare alternatives. The annual cost per acre-foot of water utilizing Alternative 3 would be approximately $111 (see Appendix 4).

ALTERNATIVE 4: PUMPING WATER FROM GREEN RIVER

General Description

Alternative 4 would provide 70,000 acre-feet of water at a constant rate of 97 cfs to the vicinity of the proposed White River Dam site. Water would be released from Flaming Gorge Reservoir into the Green River. The water would then flow downstream approximately 120 miles (193 km) to a point

near the mouth of Walker Hollow (Section 14, Township 6 South, Range 22 East), about 5 miles (8 km) south of Jensen, Utah, where it would be pumped to the vicinity of the proposed White River Dam for distribution to water users (Figure 2-18).

Flaming Gorge Reservoir, constructed as a feature of the Colorado River Storage Project, is located on the Green River in northeastern Utah and southwestern Wyoming. It is approximately 70 miles (112 km) north of the White River and Oil Shale Tracts Ua and Ub. Water would be provided from Flaming Gorge Reservoir in a continuous flow to provide the required 97 cfs.

Project elements required to provide water to the vicinity of the proposed White River Dam would include a river pumping station, a settling pond and sluiceway, two high-lift pumping stations, and approximately 28 miles (45 km) of buried welded steel pipeline.

Pumping Facilities and Pipelines

The river pumping stations would be located on the south bank of the Green River (Section 14, Township 6 South, Range 22 East). The pumps would lift raw water from the river and transport it about 1,000 feet (305 m) to a settling pond, as shown in Figure 2-19. Sediment would be returned to the river through a sluiceway. A second pumping station would lift the water about 500 feet (152 m) from the settling pond to a small regulating reservoir about 4.5 miles (7.2 km) from the river as shown in Figure 2-18. The third pumping station would transport the water the remaining 24.5 miles (39.4 km) to the vicinity of the proposed White River Dam as shown in Figure 2-18. A pipeline approximately 54 inches (137.2 cm) in diameter would be used to transport the water. The pipeline right-of-way would be 110 feet (33 m) wide and much of the alignment would be along an existing power line corridor. Bedding material for the pipe would be obtained from local commercial sources such as the gravel pit at Jensen.

Each pumping station site would require up to 15 acres (6 ha) for the pumping station structures and regulating reservoirs. An all-weather access road and power supply would be required for each pumping station. The power line would follow the pipeline route.

Water Right

The WPRS owns Water Right Application No. 30414, which has a priority date of August 7, 1958. The contract for use of water from the Flaming Gorge Reservoir, including the purchase price, is subject to negotiation according to information contained in a report entitled, "Alternative Sources of Water for Prototype Oil Shale Development, Colorado and Utah, Bureau of Reclamation, Upper Colorado Region, Salt Lake City, Utah, September, 1974."

Construction

Construction activities would include construction of the pump station and pipeline. Approximately 50 percent of the trench excavation would be rock excavation. Manpower requirements for construction would be 80 to 100 workers for 2 years.

Comparative Cost

A very rough cost estimate was made to compare alternatives. The annual cost per acre-foot of water under Alternative 4 would be approximately $118 (see Appendix 4).

ALTERNATIVE 5: PUMPING WATER FROM WHITE RIVER AND SUPPLEMENTING WITH WATER PUMPED FROM THE GREEN RIVER

General Description

With Alternative 5, the main water supply (97 cfs) would be pumped from the White River and in normal years supplementary water would not be required as indicated for Alternative 3. Individual diversions and pumping stations along the White River required by the various developers will not be discussed here but would require separate environmental analyses. During dry years, water would be pumped from the Green River via pipeline to supplement the White River water (Figure 2-18). The water would be released from Flaming Gorge Dam

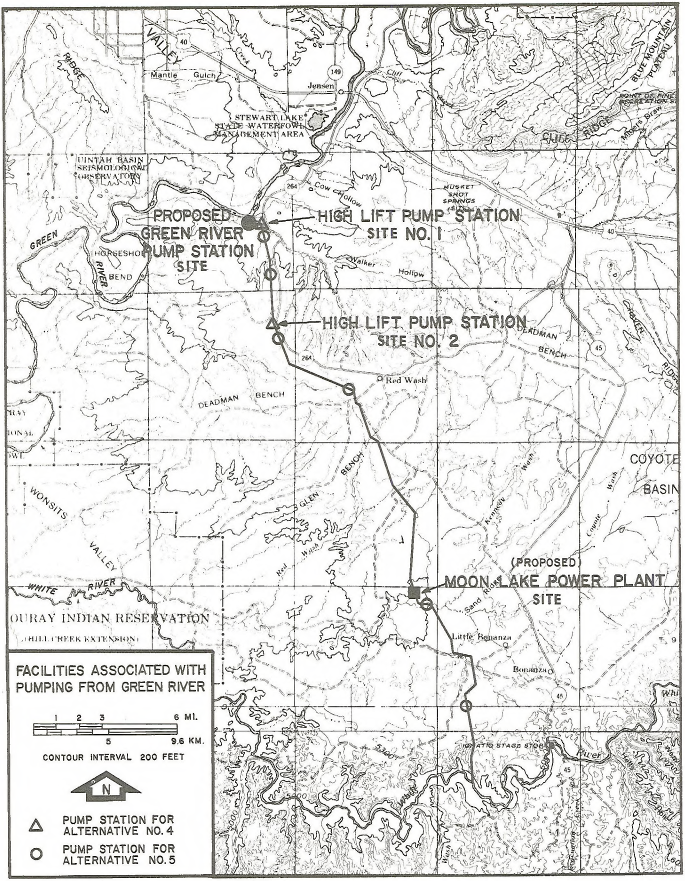

Figure 2-18

FACILITIES ASSOCIATED WITH ALTERNATIVES 4 AND 5, PUMPING FROM THE GREEN RIVER

as in Alternative 4. As discussed earlier, supplementary water was needed in only 1 year (1977) out of the last 50 years in the White River. In such a year, 39,000 acre-feet would have been needed to be pumped from the Green River. A theoretical worst case situation would require 70,000 acre-feet from the Green River. Therefore, the capacity of the pipeline and pumping system was designed to be 70,000 acre-feet per year, the same as Alternative 4. However, since water would only be pumped from the Green River at infrequent intervals, it would be more economical to use a smaller pipeline and greater pumping energy for this alternative. The general pipeline alignment would be the same for this alternative as for Alternative 4, and the right-of-way would also be 110 feet (33 m) wide.

Project elements required to provide water to the vicinity of the proposed White River Dam would include a Green River pumping station, a settling pond and sluiceway, six high-lift pump stations, and approximately 29 miles (46.7 km) of buried welded steel pipeline.

Pumping Facilities and Pipelines

The river pumping station and settling pond would be located at the same locations as in Alternative 4 (Figure 2-19). Although a settling pond was used in developing this alternative, it might not be necessary to have the settling pond if the water were pumped directly to the White River pumping station for distribution. Six high-lift pumping stations at the approximate locations shown in Figure 2-18 would be used to pump the water from the Green River to a point near the location of the proposed White River Dam. A power line system would follow the pipeline route to provide power to the pump stations.

A buried welded steel pipeline approximately 36 inches (91.4 cm) in diameter would be used to transport the water. Bedding material for the pipeline would be obtained from commercial sources such as the Jensen pit.

Construction

Construction activities would include construction of the pump station and pipeline. During construction of the pipeline, approximately 50 percent of the trench excavation would probably be rock excavation. Manpower requirements for the project would be approximately 60 to 70 workers for 2 years.

Comparative Cost

A very rough cost estimate was made to compare alternatives. The annual cost per acre-foot of water under Alternative 5 would be approximately $78 (see Appendix 4).

COMPARATIVE ANALYSIS

Table 2-1 compares the unavoidable adverse impacts of the alternatives by environmental element. Unavoidable adverse impacts are negative environmental impacts that remain despite mitigation efforts. Adverse impacts which are of low significance or of very short duration are not included. Table 2-1, therefore, should be used to compare and contrast the environmental impacts of the alternatives.

Alternatives 1, 3, 4, and 5 have essentially the same impact from the standpoint of water depletion (about 70,000 acre-feet/year) and human resources (all utilize about the same number of people).

As a whole, the adverse environmental impacts of Alternative 1, the White River Dam, are greater than any other alternative, and the environmental impacts of Alternative 2, No Action, are the lowest of any alternative. The No Action Alternative would have the least impact since no proposed water development would occur.

Alternative 1 would both disturb and occupy more land than the other three project alternatives. Alternative 1 would occupy and disturb between 3,604 to 3,661 acres (1,458 to 1,482 ha) depending upon which transmission line and access road alternative was selected. Alternative 3 would occupy and disturb 339.5 acres (137 ha). Alternative 4 would occupy and disturb 425 acres (172 ha). Alternative 5 would occupy and disturb 485 acres (196 ha). Table 4-1 gives a more detailed breakdown of acreages disturbed and occupied by project alternative components.

The number of acres occupied causes greater losses to minerals, paleontology, soils, floodplains, vegetation, and cultural resources. The loss of a significant area of riparian habitat causes greater losses to terrestrial ildlife, recreation, visual resources, and livestock grazing. The presence of a mainstream dam on the White River could cause greater impact to the aquatic wildlife in both the White and Green Rivers, including three endangered species of fish.

The only impact associated with alternatives other than the White River Dam that is more impor-

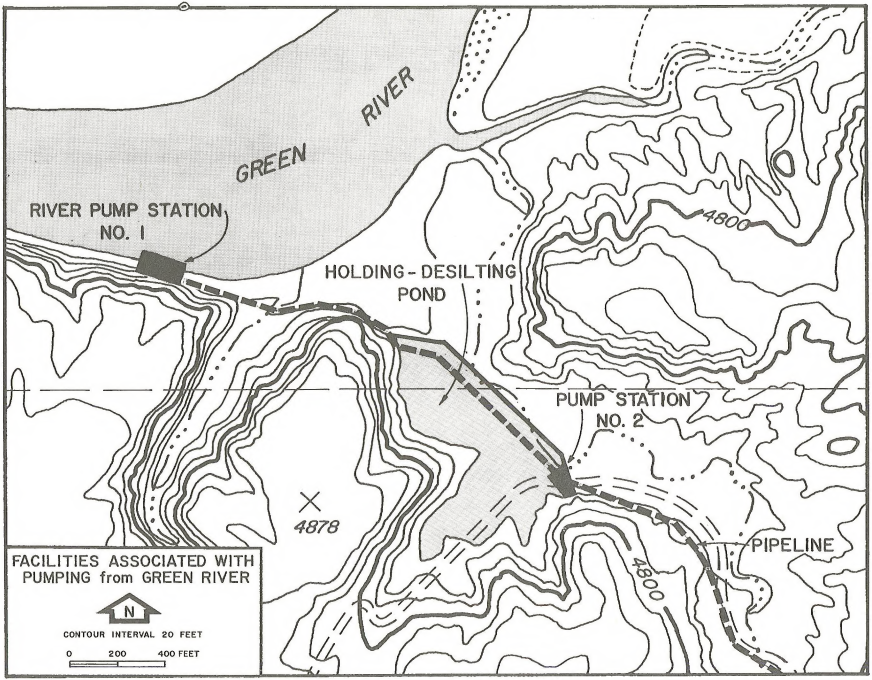

Figure 2-19

RIVER PUMP STATIDN AND SEDIMENT PONDS ASSOCIATED WITH ALTERNATIVE 5, PUMPING FROM THE GREEN RIVER

TABLE 2-1

Comparative Summary of Significant Unavoidable Adverse Impacts

Environmental Elements (Resource)	Alternative 1 White River Dam	Alternative 2 No Action	Alternative 3 Pump From White River - Supplement With Hell's Hole Canyon Dam Water	Alternative 4 Pump Water From Green River	Alternative 5 Pump Water From White River - Supplement With Water From Green River
Minerals	Unquantifiable amounts of oil shale and other minerals would not be available for extraction during the life of the project on the 1,860 acres (753 ha) inundated by the reservoir.	None.	Some loss of oil shale recovery would occur on about 295 acres (119 ha).	None.	None.
Paleontology	Some fossils potentially important to science could be lost on 3,600 acres (1,457 ha).	None.	An unquantifiable number of important fossils could be destroyed on 315 acres (127 ha).	An unquantifiable number of fossils important to science could be lost on the 380 acres (154 ha) disturbed.	Same as Alternative 4.
Soils	An unquantifiable amount of soil would be lost on 1,787 acres (723 ha) due to erosion and removal of construction material at dam site.	None.	A small amount of soil would be lost by erosion from disturbed areas.	An unquantifiable amount of soil would be lost by erosion on the 380 acres (154 ha) disturbed.	Same as Alternative 4.
Water Resources	A 67,000 acre-foot yearly depletion in flows of the White and Green Rivers.	None.	Depletions of 70,000 acre-feet from the White and Green Rivers.	The Green River would be depleted by 70,000 acre-feet of water per year.	Same as Alternative 3.
	A 3.4 mg/l increase in salinity at Imperial Oam would occur.	None.	A 3.4 mg/l increase in salinity at Imperial Dam would occur.	A 3.4 mg/l increase in salinity at Imperial Oam would occur.	Same as Alternative 3.
	The channel of the White River below the dam would be armored as fine sediments would be scoured out of the bed.	None.	None.	None.	None.
	Below the dam, water temperature would decrease and water clarity would increase.	None.	None.	None.	None.
	Sedimentation of the reservoir would be unavoidable and would impact the long-range future utility of reservoir storage.	None.	None.	None	None.
Floodplains	About 995 acres (403 ha) of riparian floodplain would be inundated. Another 4,575 acres (1,852 ha) below the dam would be affected by decreased flows and armoring, causing a decrease in total riparian acreage.	None.	None.	None.	None.

(continued)

TABLE 2-1 (continued)

Environmental Elements (Resource)	Alternative 1 White River Dam	Alternative 2 No Action	Alternative 3 Pump From White River - Supplement With Hell's Hole Canyon Dam Water	Alternative 4 Pump Water From Green River	Alternative 5 Pump Water From White River - Supplement With Water From Green River
Vegetation					
General	About 995 acres (403 ha) of riparian and 557 acres (225 ha) of upland vegetation would be inundated by the reservoir. An additional 1,777 acres (719 ha) of upland vegetation would be temporarily disturbed and an unquantifiable amount of downstream riparian floodplain vegetation would be lost or modified on 4,575 acres (1,851 ha).	None.	Loss of 0.5 acre (0.2 ha) of riparian and 339 acres (132 ha) of upland vegetation would occur.	Up to 15 acres of riparian vegetation and up to 79 acres of upland vegetation would be occupied by three pump stations and an access road. Disturbed acres could require up to 15 years for native vegetation to become re-established.	Same as Alternative 4 except loss of an additional 60 acres (24 ha) of upland vegetation.
Threatened, Endangered, and Sensitive Species	One population of a potentially new species of *Penstemon* would be inundated.	None.	None.	A small but unquantifiable number of Uinta basin hookless cactus may be destroyed, but the loss would not jeopardize their continued existence.	None.
Terrestrial Wildlife					
Mammals	The inundation of about 995 acres (403 ha) of riparian habitat would result in the loss of up to: 176 beaver; 25,000 deer mice; 3,200 bushytailed woodrats; 26 porcupines; 189 cottontails; and 200 deer. Unquantified additional loss to these species would occur in the riparian area along the White River below the dam. Additional unquantified deer losses would occur in surrounding areas which presently rely on the White River riparian area for fawn production.	None.	None.	None.	None.
Birds	Loss of about 995 acres (403 ha) of riparian habitat would displace 90 of 126 species of nongame birds. Reduction of raptor population would occur due to loss of prey species (especially during drought conditions.	None.	None.	None.	None.

(continued)

TABLE 2-1 (continued)

Environmental Elements (Resource)	Alternative 1 White River Dam	Alternative 2 No Action	Alternative 3 Pump From White River - Supplement With Hell's Hole Canyon Oam Water	Alternative 4 Pump Water From Green River	Alternative 5 Pump Water From White River - Supplement With Water From Green River
Birds (continued)	An annual production of 36 Canada geese would be lost from the reservoir basin and an additiohal small but unquantifiable amount of goose production lost from the White River below the dam.	None.	None.	None.	None.
Threatened and Endangered Species.	None.	None.	None.	None.	None.
Aquatic Wildlife					
White River					
General	The native aquatic ecosystem would be lost in the 13.5 miles (22 km) of the reservoir and altered in the 50 miles (80 km) below the dam. A partial loss of native fauna would occur in the lower 10-20 miles (16-32 km) of the White River.	None.	Although releases from Flaming Gorge would moderate the impact, the cumulative loss of water from this project and additional depletions from other future projects on the White River could cause a loss of the native ecosystem in the White River.	None.	Same as Alternative 3.
Threatened and Endangered Species	Blockage of the White River channel and change in water quality would result in loss of habitat for the Colorado squawfish.	None.	The Hell's Hole Canyon Project would not adversely impact endangered fish utilizaation of the White River by itself. However, the cumulative loss of flows in the White River from this project and other future projects could eliminate the White River as squawfish habitat due to insufficient flow.	None.	Same as Alternative 3.
Green River					
General	The proposed White River Dam would not adversely affect aquatic habitat of the Green River; however, the cumulative loss of 70,000 acre-feet of water from this project and from a number of other proposed projects could cause the aquatic ecosystems of the Green River to change significantly.	None.	The Hell's Hole Canyon Project would not adversely impact the ecosystem of the Green River by itself; however, the cumulative loss of 70,000 acre-feet of water from this project and from a number of other proposed projects could cause the aquatic ecosystems of the Green River to change significantly.	Alternative 4 would not adversely impact the aquatic ecosystem of the Green River by itself; however, the cumulative loss of 70,000 acre-feet of water from this project and from a number of other proposed projects could cause the aquatic ecosystems of the Green River to change significantly.	Same as Alternative 3. Same as Alternative 3.

(continued)

TABLE 2-1 (continued)

Environmental Elements (Resource)	Alternative 1 White River Dam	Alternative 2 No Action	Alternative 3 Pump From White River - Supplement With Hell's Hole Canyon Dam Water	Alternative 4 Pump Water From Green River	Alternative 5 Pump Water From White River - Supplement With Water From Green River
Threatened, Endangered and Species	The cumulative loss of flow in the Green River by this project and other proposed water developments in the Green River system could reduce flows sufficiently to jeopardize the continued existence of the bonytail chub and Colorado squawfish and perhaps the humpback chub and razorback sucker.	None.	The cumulative loss of flow in the Green River by this project and other proposed water developments in the Green River system could reduce flows sufficiently to jeopardize the continued existence of the bonytail chub and Colorado squawfish and perhaps the humpback chub and razorback sucker.	The cumulative loss of flow in the Green River by this project and other proposed water developments in the Green River system could reduce flows sufficiently to jeopardize the continued existence of the bonytail chub and Colorado squawfish and perhaps the humpback chub and razorback sucker.	Same as Alternative 3.
Recreation	13.5 miles (22 km) of canoeing stream would be lost.	None.	None.	None.	None.
	Up to 936 hunter days per year for deer would be lost in the State of Utah, along with a small but unquantifiable loss in hunter days for geese.	None.	None.	None.	None.
Visual Resources	The current BLM Class II Visual Resource Management Objectives would not be met.	None	Land disturbance would remain for the period until revegetation became fully establisted, for approximately 15 years.	None.	None.
Land Use	A loss of forage for 23 cattle grazing 4.5 months on public land would occur. This reduction in livestock production would cause an economic loss to the rancher.	None.	Grazing for 11 sheep for 4 months each year on public lands would be lost.	None.	None.
	The current BLM Bonanza Management Framework Plan would not be met.	None.	None.	The BLM Bonanza Management Framework Plan would not be met in that the pipeline route would not follow existing utility corridors.	Same as Alternative 4.
Cultural Resources	Some unquantifiable cultural resources may be destroyed or damaged during construction activities. Increased ease of access and use of the area may increase the potential for vandalism of archaeological sites.	None.	A small but unquantifiable number of cultural sites important to science and education could be lost.	An unquantifiable number of educational and scientific cultural sites may be lost even with the suggested mitigation. It is doubtful that any significant sites would be lost.	
Human Resources	None.	None.	None.	None.	None.
Energy Analysis a. Construction b. Annual Operation	 7.7×10^{11} Btu Negligible use more than offset by 9.9 x 10^{9} Btu produced.	 None. None.	 7.6×10^{11} Btu 1.3×10^{10} Btu	 4.1×10^{12} Btu 4.8×10^{11} Btu	 2.3×10^{12} Btu 1.2×10^{11} Btu

tant than the similar impact on Alternative 1 is the potential loss of an endangered plant, the Uinta Basin hookless cactus, along the pipeline routes of Alternatives 4 and 5. The impact on this endangered cactus is not expected to jeopardize the species or any of its populations.

Results of the Energy Analysis that appear in Chapter 4 are also summarized at the end of Table 2-1. Construction of the White River Dam Project (Alternative 1) and the Hell's Hole Canyon Dam Project (Alternative 3) both would use about the same amount of energy, $7X10^{11}$ British thermal units (Btu), which was the lowest amount. Pumping from the Green River (Alternative 4) would be the most energy intensive, requiring $4.1X10^{12}$ Btu for construction and $4.9X10^{11}$ Btu annually due to the electrical requirement of pumping. Supplementing from the White River water by pumping occasionally from the Green River (Alternative 5) also would require a fairly high energy requirement. During operation, the White River Dam Project would be the only one of the alternatives which would be a direct producer of energy, with the hydroelectric power plant output of up to $9.9x10^{10}$ Btu per year.

Table 2-2 is a summary of the approximate cost of construction and operation of the proposed alternatives for 50 years. Annual costs of construction were calculated using a 12-percent interest rate and electricity was assumed to cost $0.015/KWH. Figures were based on 1979 dollars. These figures are a rough, order-of-magnitude cost to be used for general comparative purposes only.

To give these numbers perspective, a 100,000 barrels/day oil production by the White River Shale Project would require 26,000 acre-feet of water. The cost of water per barrel of oil for the lowest cost alternative, the White River Dam, would be $0.023/barrel. The cost of water per barrel of oil for the highest cost alternative, pumping from the Green River, would be $0.084/barrel. Considering the cost of a barrel of oil to be in the $30 to $40 range, water costs by any of the alternatives would be a small portion of the total cost.

AGENCY-PREFERRED ALTERNATIVE

The selection of the BLM-preferred alternative is based on the information contained in this Draft EIS as well as coordination with the public and other agencies. Further coordination and comments received on the Draft EIS will be considered in the final determination of the BLM-preferred alternative as part of the Final EIS.

The State of Utah has requested the consultation process, as required under section VII of the Endangered Species Act of 1973, be extended. Consequently, BLM has requested the USFWS to delay the issuance of the proposed White River Dam Project Biological Opinion until the results of a study on endangered species in the White River are available in late 1981 or until the State of Utah requests an end to the consultation.

The USFWS has not been able to provide a Technical Assistance Report as requested by the BLM under the terms of the Fish and Wildlife Coordination Act. This report might include mitigating measures on project alternatives which could minimize impacts to nonthreatened or nonendangered species.

The BLM intends to utilize the Biological Opinion and Technical Assistance Report when received. In the event that the Biological Opinion indicates that the construction and operation of the White River Dam would not jeopardize the threatened and endangered species in the area, the BLM-preferred alternative would be the granting of rights-of-way to the State of Utah for the proposed White River Dam Project, subject to appropriate mitigating measures to minimize environmental impacts. Until the two documents noted above are received, BLM proposes to follow the "No Action" alternative.

The new USFWS information and the public comments on this Draft EIS may or may not lead to the selection of a different agency-preferred alternative than now identified by BLM.

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TABLE 2-2

A Comparison of Rough Cost Estimates
for Each of the Alternatives

	Alternatives			
	White River Dam	Hell's Hole Canyon Dam to Augment White River	Pumping From Green River	Pumping From Green to Augment White River
<u>Construction Cost</u>				
Total ($)	18,500,000	23,400,000	51,200,000	41,000,000
Annual ($/yr)	2,230,000	2,820,000	6,170,000	4,940,000
Annual Power Cost ($/yr)	--[a]	60,000	2,060,000	520,000
Total Annual Cost ($/yr)	2,230,000	2,880,000	8,230,000	5,460,000
Quantity of Water Supplied (ac-ft)	70,000	25,000	70,000	70,000
Cost of Water ($/ac-ft/yr)	32	111	118	78

[a]Annual power income of approximately $1,150,000 (based on $0.04 per KWH) is not included in the comparison as it may not be applied to the water cost. Rather, it may be returned to the State Water Fund directly as a separate item.

CHAPTER 3

THE AFFECTED ENVIRONMENT

INTRODUCTION

This chapter describes only the affected environment, which is that portion of the existing environment that would be impacted by the proposed action or an alternative. The project area covers the portion of Utah shown in Figure 2-1. Rivers of concern are the White River in Utah and the Green River from Walker Hollow to its mouth. All environmental factors have been considered during the scoping process, the addressing of issues, and the preparation of this EIS.

For discussion (or identification) purposes in this EIS, the following definitions are used:

> ***Regional Setting***: That portion of the Uinta Basin included in Figure 2-1.
>
> ***Project Area***: Specific land areas or corridors that would be utilized by the project alternatives or major components.

REGIONAL SETTING

The region lies in northeastern Utah in the southeastern portion of the Uinta Basin. The topography is generally gently rolling hills at approximately 5,500 feet (1,675 m) elevation, with a rather sharp drop of about 600 feet (183 m) to the White River floodplain. The region is dissected by dry washes which form rather steep canyons near the White River.

The region has a semi-arid continental climate, characterized by meager precipitation (approximately 8 inches (20 cm) per year), extreme evaporation, cold and dry winters, and hot and dry summers (US Department of Agriculture, Forest Service, 1978, Hidore 1972). Precipitation is greatest in spring and early fall, primarily through thunder storms. Average annual snow accumulation is about 10 inches (25 cm) (Utah Division of Water Resources 1979) but south-facing areas may remain free of snow for most of the winter. Mostly clear skies, intense daytime sunlight, and rapid nighttime cooling result in wide daily temperature ranges (National Oceanic and Atmospheric Administration (NOAA) 1974). The average July maximum temperature is 95F (35C) and the mean daily July temperature is 75F (24C), reflecting the sharp nocturnal cooling.

Air quality in the study area is good, reflecting the lack of significant sources of human contamination (VTN Colorado, Inc. 1977). Some local areas of poor air quality exist around such human activity as drilling rigs, roads, and the gilsonite plant at Bonanza.

GEOLOGY

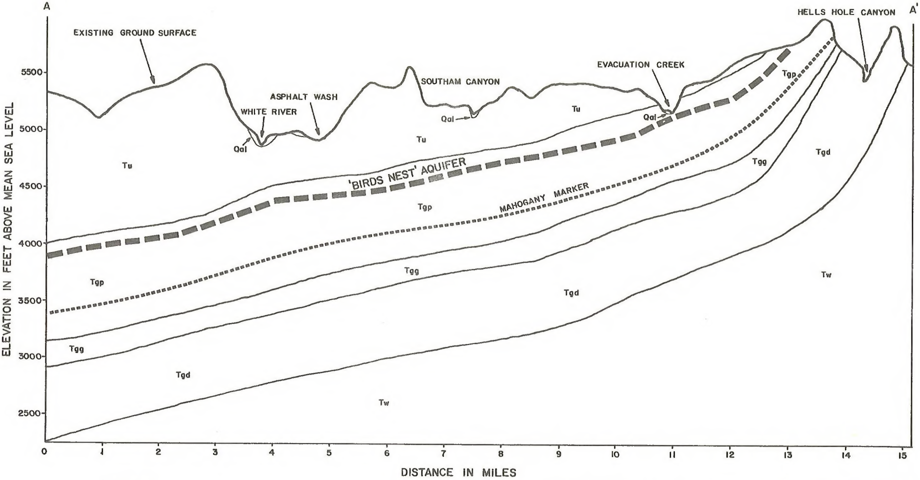
Three geologic formations of Eocene Age (60 million years ago) are exposed at the surface in the. immediate project area. The lowest of those is the Green River Formation, consisting of approximately 1,600 feet (487 m) of light-to-dark gray, hard, dense, marlstone and oil shale interbedded with lesser amounts of sandstone, siltstone, limestone, and volcanic tuff. This formation is exposed only in the eastern part of the area. The rich mahogany zone oil shales are present about 500 feet (152 m) below the top of the formation (Figure 3-1).

The next higher formation is the Uinta Formation, consisting of approximately 1,000 feet (305 m) of stream deposited sandstone and siltstone interbedded with minor amounts of shale and conglomerate.

The Duchesne River Formation overlies the Uinta Formation and is incompletely exposed on the northwestern part of the project area where it forms badland topography. Its constituents include reddish stream-deposited siltstone, sandstone, and conglomerate.

Quaternary terrace deposits of pebbles and cobbles occur sporadically on terrace remnants flanking the White River. River floodplain alluvium consisting of sand and silt underlies White and Green River valleys, attaining a thickness of up to 50 feet (15 m) along the White River.

Rock structure within the area is relatively simple, with a few degrees northwestward tilt (dip) of the strata, flattening toward the northwest. Sets of northwest-trending and northeast-trending near-vertical joints are found throughout the area. The northwesterly trend is predominant. Some are offset a few feet and would be characterized as minor faults. These are the only faults observed in the area. The gilsonite deposits near Bonanza occupy some of the northwest-trending joints and faults. Release joints (sheeting) were observed paralleling the river valley in steep sandstone cliffs at



LEGEND

QUATERNARY

Qal ALLUVIUM

TERTIARY

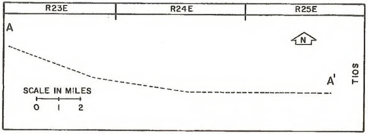
Tu UINTAH FORMATION

Tgp PARACHUTE CREEK MEMBER

Tgg GARDEN GULCH MEMBER — GREEN RIVER FORMATION

Tgd DOUGLAS CREEK MEMBER

Tw WASATCH FORMATION



LOCATION OF CROSS-SECTION

REGIONAL GEOLOGIC CROSS-SECTION

THROUGH WHITE RIVER DAM STUDY AREA

Figure 3-1

GEOLOGIC FORMATION IN THE PROJECT AREA NEAR HELL'S HOLE CANYON

Source: VTN, Inc. 1977

the White River Dam site, and may be present elsewhere in cliff faces.

The project area is one of low earthquake hazard, as categorized on the Earthquake Hazards Map of the United States. No active faults are known within approximately 100 miles (160 km) of the area, although minor earthquake activity in the area of the Rangely oil field, 20 miles (32 km) to the northeast, seems clearly attributable to minor adjustment along faults related to oil field operations. Geologic features of linear routes are shown in the Environmental Profiles (Figures 3-11 to 3-16) at the back of this chapter.

MINERALS

Oil and Gas

Several oil and gas fields exist in the regional setting of this project. The Red Wash Oil Field is crossed by Alternatives 4 and 5. Some gas wells are located within the project area. One well is only 1.5 mile (2.4 km) north of the proposed White River Dam site. Exploration and drilling activity is occurring throughout the region. Figure 3-2 shows the location of leases affected by the project alternatives. Table 3-1 lists the project alternatives and the number of leases affected by each.

Oil Shale

The project area for the White River Dam lies adjacent to Federal Oil Shale Lease Tracts Ua and Ub, being developed by the White River Shale Project. These are the major oil shale leases in Utah and encompass a total of 10,240 acres (4,144 ha). Other adjacent leases include TOSCO Corporation's 14,000-acre (5,666 ha) lease on State land along the White River about 30 miles (48 km) downstream from the proposed White River Dam. Paraho Corporation plans to develop a prototype oil shale retorting plant near Cowboy Canyon at the upper end of the proposed White River Reservoir. Other smaller leases also occur in the region. High-grade oil shale underlies about 1,000 square miles (2,590 km²) of the eastern Uinta Basin and contains 80 billion barrels of oil (Cashion 1967).

All Federal lands in the project area have been withdrawn from mineral entry since 1920. The vast resources of oil shale prompted the withdrawal. Over 200 pre-1920 unpatented oil shale mining claims occur in the project area. Only a small number of these would be affected by the proposed alternatives as indicated in Figure 3-3, primarily at the upper end of the White River Reservoir and in Hell's Hole Canyon.

Other Minerals

Minerals besides oil shale found in this area include other hydrocarbons, primarily gilsonite. The Town of Bonanza is near the major active gilsonite mine in the United States. Tar sands are also found in the area, primarily in the Green River Formation below the oil shale layers. These sands are estimated to contain 7 billion barrels of bitumen (US Department of the Interior (USDI), BLM, 1973).

PALEONTOLOGY

The Uinta Basin has a rather long and detailed history of paleontological discovery and analysis. Much of the paleontological literature of Utah pertains to this area. Therefore, the White River area has had considerable paleontological study (Bradley 1931, 1970, Brown 1934, Carpenter 1955, Cashion 1957, 1967, Chaney 1944, Cross and Wood 1975, Dane 1954, Davis 1916, Haj 1908, Knowlton 1923, Macginitie 1969, Madsen and Nelson 1979, Miller 1975, Miller and Webb 1980, Peterson 1914a, 1924, Riggs 1912, Robison 1978, Ryder and Fouch 1974, Scudder 1892, and Winchester 1918). The major fossil-bearing layers of the affected area are the Green River and Uinta Formations. Table 3-2 lists the known fossils from these two formations from the Uinta Basin.

The known fossil assemblage in the Uinta Basin has enabled paleontologists to construct a reasonably accurate history of this area, covering a several-million-year span including evolutionary changes, climatic regimes, and appearance and extinction of life forms. For example, the earliest record of camels and ducks comes from the Uinta Basin. The Cenozoic Era (the last 65 million years) has been divided into the shortest recognizable time intervals on the basis of fossil mammals. Two of these time intervals for North America, the Uintan and Duchesnean, are based on fossil mammals from the Uinta Basin.

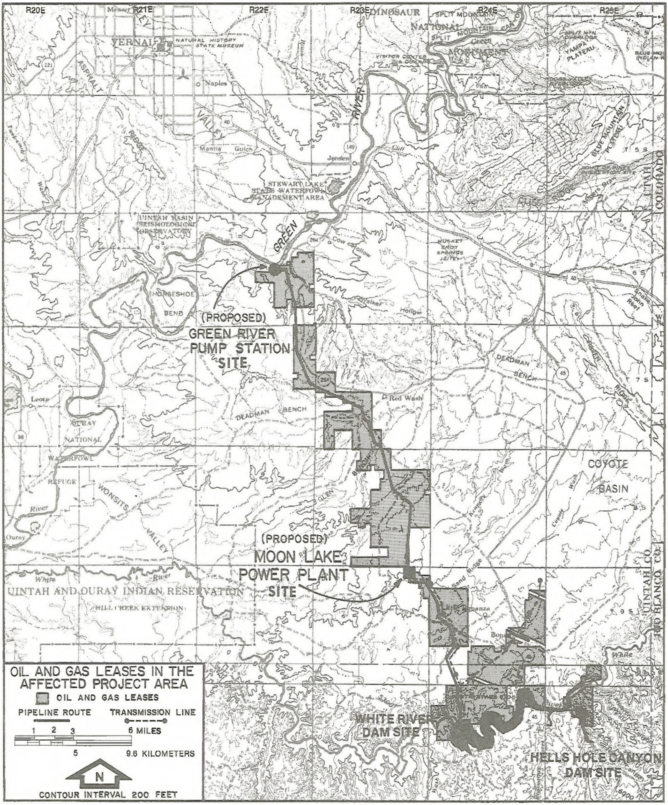


Figure 3-2
OIL AND GAS LEASES IN THE PROJECT AREA
Source: Bureau of Land Management 1980

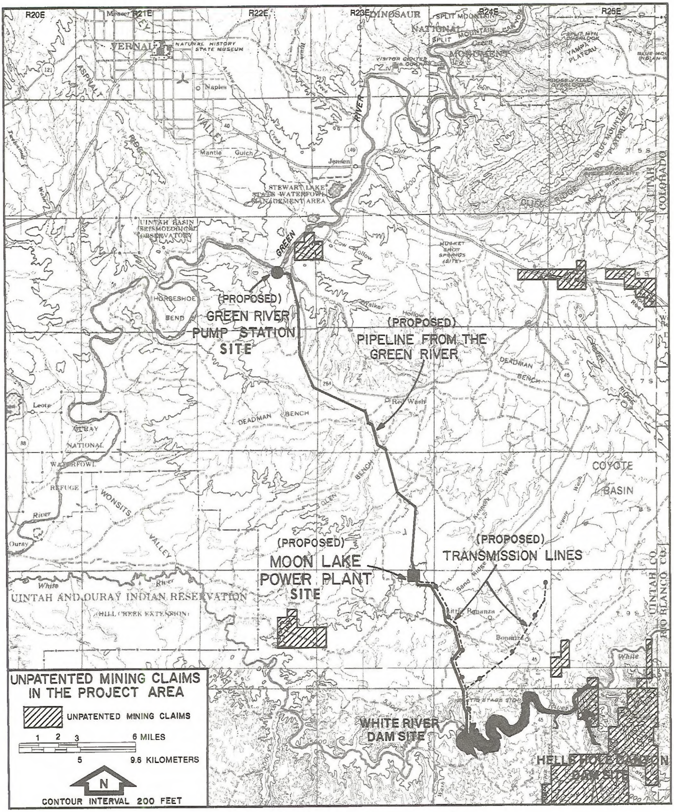


Figure 3-3
UNPATENTED MINING CLAIMS IN THE PROJECT AREA
Source: Bureau of Land Management 1980

TABLE 3-1
Oil and Gas Leases Within the Project Area[a]

Alternatives	No. of Leases
White River Dam	
Dam and Reservoir	11
Access Roads	
Bonanza to Dam (Alt. A)	8
Wagon Hound Canyon to Dam (Alt. B)	7
Transmission Lines	
Dam to Moon Lake Power Plant	8
Dam to Existing Powerline	14
Hell's Hole Canyon Dam and Access Roads	1
Green River Pipeline (Alt. 4 and 5)	40

[a]Maximum size of BLM leases is 2,560 surface acres.

TABLE 3-2
Known Fossils From Two Formations in the
White River Dam

Uinta Formation			Green River Formation	
Plants			Plants	
conifers			bacteria	algae
palm			fungi	conifer
sycamore			mold	angiosperms[a]
unidentified angiosperms			ferns	petrified wood
			moss	
Invertebrates			Invertebrates	
mollusks			protozoans	ostracods
ichnites[b]			sponge spicules	spiders
ostracods			snails	insects[c]
			clams[d]	ichnites[b]
Vertebrates			Vertebrates	
fish	uintatheres[e]	entelodonts[e]	fish	rodents
turtles	tillodonts[e]	oreodonts[e]	turtles	bats
lizards	taeniodonts[e]	agriochoerids[e]	lizards	ichnites[b]
crocodiles	perissodactyls	leptomerycids[e]	snakes	
birds	titanotheres[e]	hypertragulids[e]	crocodiles	
marsupials	rhinoceroses	camels	birds	
primates	horse	rabbits	marsupials	
insectivores	tapirs	rodents	primates	
creodonts[e]	chalicothere[e]	ichnites[b]	insectivores	
carnivores	artiodactyls		condylarths[e]	
condylarths[e]	dichobunids[e]		titanotheres[e]	

Source: Miller and Webb 1980.

[a]Flowering plants.

[b]Fossil tracks and burrows.

[c]Extremely abundant and varied.

[d]Including oysters.

[e]extinct group.

SOILS

Soils within the project area are of the highly erodable desert type with moderate to low permeability. With the exception of soils in the floodplain of the White and Green Rivers and along drainages, the soils of the project area are shallow to very shallow (less than 20 inches (50 cm) deep) and are on sloping to steep upland terraces containing many areas of rock outcrops and rock escarpments. These light colored, upland soils consist of loams and sandy loams. The soils found along intermittent stream channels in drainageways such as Hell's Hole Canyon are generally deep (more than 59 inches (150 cm)), mainly sandy loams, light colored, and moderately calcareous. Deep moderately fine textured, strongly alkaline soils occur mainly on stream terraces 50 to 100 feet (15 m to 30 m) above the White River floodplain. The soils occurring next to the White River are deep, silty, and generally have a high salt content.

The soils along the floodplain of the White River and along smaller drainageways in the area have formed from alluvium deposition. The alluvium along the White River is derived from a wide range of transported materials, whereas the materials in the smaller drainages are derived locally from the Uinta and Green River Formations. The parent material for the upland soils is also derived from the Uinta and Green River Formations.

Soil characteristics found along proposed linear features (power transmission systems, water pipelines, access roads) are shown in the Environmental Profiles, Figures 3-11 to 3-16, at the back of this chapter.

WATER

The White River in Utah is currently used to only a limited extent. Bonanza, Utah has a water right to 4.2 cfs from the White River for municipal-industrial use, which they currently take near Ignatio Bridge. The Ute Indian Tribe is currently irrigating 1,000 to 1,200 acres (405 to 486 ha) of land with water from the White River near the confluence of the White and Green Rivers. A minimal amount of recreational use of the river presently occurs, primarily fishing, rafting, and canoeing. Extensive potential for increased water use in the future does exist, primarily through energy development.

Surface Water

HYDROLOGY

The White River is a tributary of the Green River, which forms part of the upper Colorado River basin. Its headwaters are located in western Colorado, where most of its flow derives from snowmelt. The river flows generally westward, reaching its confluence with the Green River at Ouray, Utah, approximately 26 miles (41 km) south of Vernal, Utah (Figure 2-1). The portion of the drainage area which encompasses the project area is arid, with only one perennial stream.

The White River at the project area drains approximately 4,020 square miles (10,412 km^2), and maintained an average annual discharge of 502,800 acre-feet during the period 1923-1978. Figure 3-4 depicts historical monthly flow on the White River. The lowest annual flow of record was 223,000 acre-feet in 1977. Peak flows in late spring range from 3,000 to 4,000 cfs, while low flows in fall and winter range from 300 to 400 cfs. Table 3-3 provides observed monthly flow in cfs for the White River at the USGS Watson gaging station located south of Bonanza, Utah, and near Ignatio Bridge (Figure 2-6).

There is presently no interstate compact between Colorado and Utah regulating the use of waters from the White River. Therefore, the possibility exists that White River flows in Utah could be altered (i.e., reduced) by an unknown amount by future potential upstream activities in Colorado. Also, the Ute Indian Tribe has a water right to irrigate lands along the lower White River below the proposed White River Dam (Winters Doctrine). At present there is uncertainty regarding the quantity of this right and whether both Utah and Colorado would be affected by it.

There are several tributary drainages entering the White River in the project area; however, only Evacuation Creek sustains flow throughout most of the year. The other drainages flow only during snowmelt and intense rainfall. In general, the contribution of other surface sources to the White River in the project area is negligible.

The White River averages 2 to 4 feet (0.6 to 1.2 m) in depth and 150 to 200 feet (46 to 61 m) in width through the project area. Water velocities exhibit considerable seasonal variation in conjunction with fluctuation in volume of flow. Instream habitat is composed primarily of runs, with some scattered riffles of rather insignificant frequency. Sand and silt predominate the substrate composition, with limited

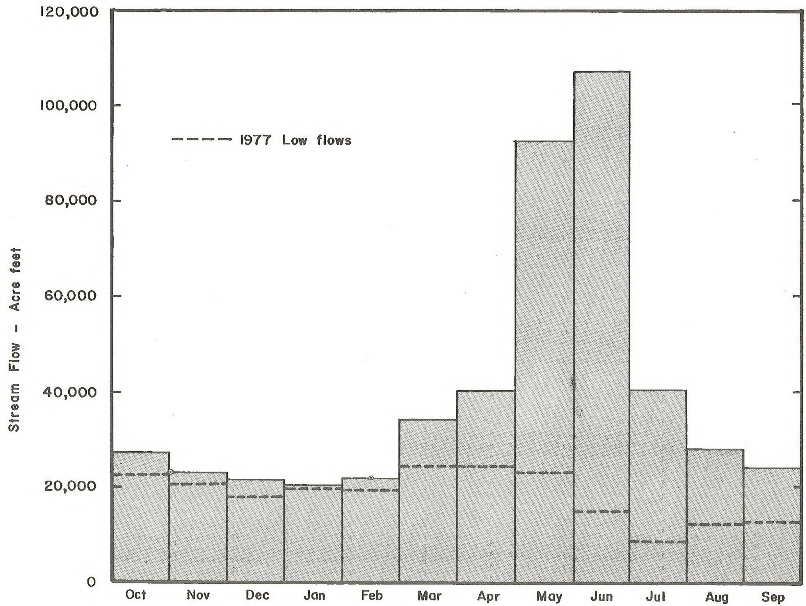


Figure 3-4

MEAN HISTORICAL RUNOFF FOR THE WHITE RIVER NEAR WATSON, UTAH (BASED ON 1931-78 RECORDS) AND 1977 LOW RECORD FLOWS

Source: Utah Division of Water Resources (1979)

occurrence of varying-sized cobbles in higher velocity riffle areas.

The Green River from Walker Hollow near Jensen, Utah, to its confluence with the Colorado River is also included in this study. Average annual flows at Jensen, Utah, and Green River, Utah, are 3,157,000 acre-feet/year and 4,568,000 acre-feet/year, respectively, which equates to 4,358 and 6,305 cfs. The river is primarily sustained by upper elevation snowmelt from watersheds lying north of the White River and has been partially regulated by Flaming Gorge Reservoir since 1962. Extreme flows recorded at Jensen are 36,500 cfs in 1957 and 102 cfs in 1904, and at Green River are 68,100 cfs in 1917 and 255 cfs in 1931.

Table 3-3 provides observed monthly flow in cfs for the Green River at Green River, Utah. Peak flows normally occur from April to July, coincidental with snowmelt. The Yampa, White, and Duchesne Rivers contribute the majority of observed runoff, as Flaming Gorge Dam stores high flows of the Green River.

The Green River from Flaming Gorge Dam to Green River, Utah, ranges from a slow, meandering river with a shifting sand substrate to a swift, rapid-filled stream with cobble-boulder bottom in deep canyons. The meandering river averages 600 to 1,000 feet (183 to 305 m) in width, while the canyon area widths average 300 to 600 feet (91 to 183 m). River depth in the upper area averages less than 6 feet (1.8 m) with holes reaching 9 to 15 feet (2.7 to 4.6 m); depths in the canyon area extend to both lower and higher extremes. Water velocities vary considerably on both a seasonal and spatial basis, ranging from 2 to 10 feet (0.6 to 3 m) per second. Aquatic habitat types vary from pool to riffle, with attendant variation in substrate type.

WATER QUALITY

Under normal circumstances, the quality of water in the White River within the project area shows a marked seasonal variation. During the months of May through July, the river is low in TDS and high in sediment load as normal TDS levels become diluted by heavy snowmelt. Conversely, TDS concentrations become high from September through February when groundwater becomes the primary source of flow and high levels of TDS begin leaching from soil and rocks (VTN Colorado, Inc. 1977).

In general, the water of the White River is hard and alkaline (VTN Colorado 1975). TDS typically range between 200 and 700 mg/l. There are relatively high levels of turbidity, with specific conductance values normally ranging between 400 and 1,400 micromhos, indicating high salinity. Trace elements are found in unusually high levels and coliform bacteria counts are generally at low to moderate concentrations. Measurements of dissolved oxygen approach saturation levels throughout the year.

Water temperatures approach or reach freezing levels during the months of November through March. Water temperatures then gradually warm to a normal maximum of approximately 80F (26C) during July and August, dropping back to freezing levels by November. The maximum recorded water temperature is 88F (31C) at the Watson, Utah, USGS station.

Sedimentation data has not been collected at the proposed dam site on the White River, but has been taken since 1974 at Ouray, approximately 50 miles (80 km) downstream. Grenney and Kraszewski (1980) calculated sediment load at Watson to be 2,200,000 tons/year. Considerable amounts of suspended sediments of small particle sizes are present in the water throughout the reaches of the river.

Surface water quality in the Green River at Jensen, Utah, is slightly saline and typical for this area, averaging approximately 460 mg/l in TDS, while values on the lower river at Green River, Utah, average approximately 550 mg/l. Water temperatures range from 32F to 86F (0C to 30C) during the year, due to solar heating. Average total sediment load at Green River, Utah, during Water Years 1964 to 1979 was 8,932,300 tons (USGS 1979).

Groundwater

HYDROLOGY

Groundwater is relatively common throughout the region, especially in alluvial areas along major streams (Austin and Skogerboe 1970). This resource is little used as yet. As a result, little is known about groundwater aquifers, storage capacities, and recharge characteristics. The most extensive information available in the project area has been developed by the White River Shale Project (VTN Colorado, 1975), which was based upon 2 years of preliminary investigations.

The principal aquifer within the project area is the Bird's Nest Aquifer. The thickness of the aquifer ranges from 90 to 205 feet (27 to 62 m) and averages approximately 115 feet (35 m) throughout the project area (VTN Colorado, 1975). Aquifer flow rates measured during drilling tests ranged from 0

TABLE 3-3

Observed Flows (cfs) During Water Years 1963-1978[a]

Month	White River Near Watson			Green River at Green River, Utah		
	Max.	Min.	Mean	Max.	Min.	Mean
Oct.	546.4	242.3	421.1	4,919.6	772.5	3,237.9
Nov.	480.6	295.8	398.5	5,772.2	1,241.9	3,411.7
Dec.	432.6	252.1	350.1	4,748.9	1,179.1	3,349.5
Jan.	435.9	266.7	353.5	4,883.8	1,157.9	3,434.0
Feb.	462.7	306.1	376.3	5,632.2	2,047.2	3,679.8
Mar.	1,014.8	388.7	520.4	6,397.9	1,618.2	4,342.5
Apr.	880.6	408.4	550.7	11,047.8	2,591.4	5,598.0
May	2,091.4	383.8	1,421.8	19,174.3	5,649.8	11,931.3
June	2,934.2	263.8	1,765.2	21,057.1	4,409.7	14,445.9
July	1,523.9	139.9	637.4	14,614.1	824.5	6,176.6
Aug.	692.8	206.5	394.8	5,617.3	1,171.0	3,536.7
Sep.	546.2	211.7	381.0	4,139.1	1,594.8	3,000.9
Annual	781.3	308.6	630.5	7,429.0	2,300.8	5,512.1

Source: USGS Water Supply Papers.

[a]Water Years 1963-1978 utilized to coincide with the closure of Flaming Gorge Dam in 1962.

to 700 gallons per minute (0 to 44 liters per second (l/s)) and averaged 30 gallons per minute (2 l/s).

Water level fluctuations in test wells indicate the occurrence of recharge and discharge periods; but data is inadequate to generalize about recharge characteristics. The potential for recharge is probably quite high in those locations where the aquifer is in contact with streambottom alluvium, and both the White River and Evacuation Creek are known to receive water from the aquifer. The aquifer appears to be at equilibrium, wherein discharge equals recharge (VTN Colorado, Inc. 1977).

Geophysical logs of oil and gas wells near the White River indicate that the Douglas Creek Member of the Green River Formation contains several hundred meters of water-bearing material.

WATER QUALITY

Groundwater use in the area is largely restricted by its quality. Quality measurements are varied throughout the project area, but are generally poor to marginal (Austin and Skogerboe 1970). The water ranges from high to very high in sodium absorption ratio, salinity, and TDS in most samples, making it of questionable value for many uses (VTN Colorado, Inc. 1977).

The data also indicate the quality of the groundwater in the vicinity of the tracts is better than that of the Bird's Nest Aquifer of the Wasatch Formation. The water quality data of Austin and Skogerboe (1970), Price and Miller (1974), and Feltis (1968) support these findings (VTN, 1977).

Wetlands

True wetlands are sparse in the project area. Two small wetland communities are located along the White River approximately 37 and 48 river miles (60 and 77 km) below the proposed White River Dam site. These communities entail an area total of 115 acres (47 ha).

Floodplains

The floodplain portions of the project area are extensive, supporting a major riparian vegetation community and associated vertebrate animal communities. There are approximately 6,049 acres (2,448 ha) of riparian floodplain on the White River in Utah from the Colorado border to the confluence with the Green River. Approximately 995 acres (403 ha) of riparian floodplain lies within the area which would be inundated by the proposed White River Reservoir and an additional 4,575 acres (1,852 ha) of riparian floodplain exists downstream from the proposed White River Dam site to the confluence of the White and Green Rivers located near Ouray, Utah.

VEGETATION

Types

The vegetation of the White River project area can generally be classified as a cold desert type. As a result of two different research groups studying the vegetation of the project area, vegetation type nomenclature is not consistent. VTN Colorado, Inc. (1977) described four broad vegetation types on Federal Oil Shale Lease Tracts Ua and Ub which would be affected by all of, or part of, the project components of Alternatives 1, 3, 4, and 5. These broad vegetation types are riparian, sagebrush-greasewood, shadscale, and juniper. Allan (1979) described several vegetation communities along the proposed water pipeline corridor from the Green River to the White River (Alternatives 4 and 5) and in the vicinity of proposed material borrow sites and transmission line routes near Bonanza (Alternative 1). For the purpose of this EIS, Allan's vegetation communities will be considered as variants of the four broad vegetation types described by VTN Colorado, Inc. (Table 3-4).

The overall range condition of the project area was considered poor by Allan (1979), Dastrup (1963), and VTN Colorado, Inc. (1977), but the BLM (Vernal District) considers the range condition overall to be fair (Evans 1980). On arid lands, such as the White River project area, improvement in range condition is slow due to low precipitation (less than 10 inches (254 mm)) and poorly developed soils.

The riparian type is restricted to streambanks, drainage areas, and areas along the White River with alluvial soils and abundant available water.

The sagebrush-greasewood and shadscale types are generally found in areas of relatively low relief, with sagebrush-greasewood occurring in depressions with relatively deeper soils. The major plant species occurring in both the sagebrush-greasewood and shadscale types are almost identical; however, the dominance of different species

TABLE 3-4

Grouping of Allan's Vegetation Communities Under the Four Broad Vegetation Types Described by VTN Colorado, Inc.

Juniper	Riparian	Sagebrush-Greasewood	Shadscale
Juniper	Riparian	Degraded Sagebrush-Grass	Mixed Brush
		Grassland	Saltbush
		Greasewood-Seepweed	Shadscale-Grass
		Sagebrush	
		Sagebrush-Grassland	
		Sand Dune Association	

Sources: Allan 1979 and VTN Colorado, Inc. 1977.

distinguishes one type from the other (Allan 1979, VTN Colorado, Inc. 1977). The juniper type occurs at higher elevations on shallow, poorly formed soils.

Figure 3-5 shows the location of the vegetation types at the White River Dam and Hell's Hole Canyon Dam Alternative sites. The Environmental Profiles, Figures 3-11 to 3-16 (located at the back of this chapter), show vegetation types along linear features of the project alternatives.

RIPARIAN

Riparian communities located within the alternative project sites are generally comprised of cottonwood, salt cedar, greasewood, big sagebrush, rabbitbrush, willow, yellow sweetclover, pepper grass, salt grass, western wheatgrass, and a variety of annuals. The acreages within the project area and below the White River Dam site to the confluence with the Green River are shown in Table 3-5.

SAGEBRUSH-GREASEWOOD

The dominant shrubs in the sagebrush-greasewood communities within the project area are big sagebrush, greasewood, and shadscale. Other major shrubs include horsebrush, hop sage, and black sagebrush. Indian ricegrass and needle-and-thread grass are the major perennial grasses. Other species include snakeweed, rabbitbrush, and several annuals. The acreages within the alternative project sites are shown in Table 3-5.

SHADSCALE

The dominant shrubs of the shadscale communities are shadscale and big sagebrush. Other major shrubs include black sagebrush, greasewood, spiny hop sage, and horsebrush. Indian ricegrass, needle-and-thread grass, and galleta grass are the major perennial grasses in this vegetation type. Other species include rabbitbrush, snakeweed, milk vetch, and a variety of annuals. The acreages within the project area are also shown in Table 3-5.

JUNIPER

Two juniper communities are found within the vegetation type, one on moderately sloping hillsides and the other on steeply sloping hillsides. The communities are basically the same except for the disparity in topography and plant density. The communities are dominated by Utah juniper. Black sagebrush, shadscale, and big sagebrush are the major shrubs. Galleta grass and Indian ricegrass are the dominant perennial grasses. Other species include snakeweed, spurge, wild buckwheat, rabbitbrush, and several annuals. The juniper communities usually occur on sandstone outcrops above an elevation of 5,500 feet (1,675 m).

The water pipeline from the Green River to the White River (Alternatives 4 and 5) would involve 380 acres (154 ha), the majority of which are covered by shadscale, with small amounts of sagebrush-greasewood in the draws above the river and riparian along the banks of the Green and White Rivers. A very limited amount of juniper vegetation would be encountered along the proposed route.

Productivity and Cover

Plant productivity data for the vegetation types in the White River Dam-Hell's Hole Canyon Dam area indicate that the three upland types (sagebrush-greasewood, shadscale, juniper) are similar in productivity, and that the riparian type is the most productive (Table 3-6). The differences in production between the riparian and upland areas are visually evident in Figure 3-6. No productivity data are available for the vegetation types along the water pipeline corridor from the Green River to the White River.

Another measure of environmental effects on vegetation types is the amount of bare ground in each type. The average plant cover for the three upland types (sagebrush-greasewood, shadscale, juniper) in the White River Dam-Hell's Hole Canyon Dam area is approximately 15 to 20 percent of the ground area, whereas plant cover in the riparian type adjacent to the White River is 80 percent (VTN Colorado, Inc. 1977). In a dry year, the amount of plant cover may fall below 10 percent in the upland areas (VTN Colorado, Inc. 1977).

Threatened, Endangered, and Sensitive Plant Species

The only federally listed species known to occur in the project area is the Uinta Basin hookless cactus (*Sclerocactus glaucus*), and it is listed as threatened. Welsh and Neese (1979) found this species along the proposed Green River Pipeline route (Alternatives 4 and 5). A population of what

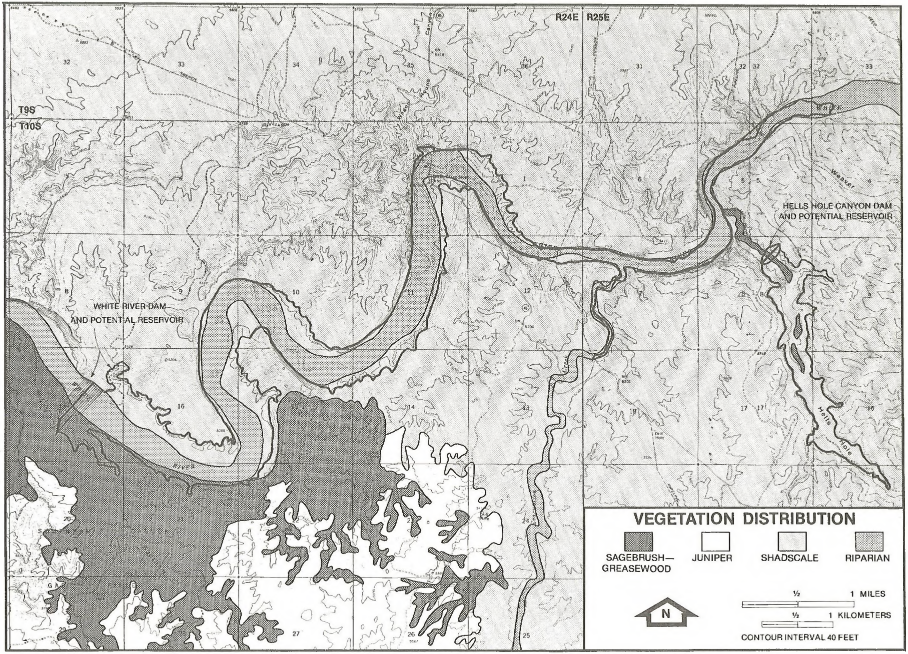


Figure 3-5
VEGETATION TYPE MAP FOR THE WHITE RIVER PROJECT AREA
Source: VTN, Inc. 1977

Figure 3-6

AERIAL PHOTOGRAPH OF THE WHITE RIVER RIPARIAN COMMUNITY CONTRASTED WITH THE SURROUNDING UPLAND HABITATS

TABLE 3-5

Acreages of Potentially Affected Vegetation Types for the Various Project Alternatives

Project Alternative	Vegetation Type[a]	Acres of Vegetation[b]
1. White River Dam and Reservoir		
Dam and Reservoir	R[c]	995
	S-G, S	547
Material Sites (off-site)	S-G, S	1,539
Access Roads		
To Dam (Alt. A and C)	J, S-G, S	57
(Alt. B and C)	J, S-G, S	56
To Reservoir (Alt. D)	S-G, S	31
(Alt. E)	S-G, S	59
Transmission Lines		
To Moon Lake Site 3	J, R, S-G, S	66
To Moon Lake Powerline	J, R, S-G, S	74
White River to Confluence With Green River	R	4,575
	W	115
3. Pumping From White River and Augmenting From Hell's Hole Canyon		
Dam and Reservoir	S-G	14
	S	261
Material Sites	J, S-G, S	Unknown
Access Roads and Power-lines	J, R, S-G, S	61
Pipeline and Pump Station	R, S-G	3.5
4. Pumping From Green River		
Pipeline, access road, and power lines	J, R, S-G, S	380
Pumping System	J, R, S-G, S	45
5. Pumping From White River and Augmenting From Green River		
Pipeline, access road and power lines	J, R, S-G, S	380
Pumping Station	J, R, S-G, S	105

Sources: Determined from vegetation type maps (Allan 1979 and VTN Colorado, Inc. 1977) and USGS topographic maps.

[a]Vegetation type symbols: J = Juniper, R = Riparian, S-G = Sagebrush-Greasewood, S = Shadscale, and W = Wetland.

[b]Assume 80 ft. corridor for access roads, 110 ft. for pipelines, and 60 ft. for powerlines.

[c]Riparian acreages do not include river channel.

TABLE 3-6
General Comparison of Production of Vegetation Types in the White River Dam - Hell's Hole Canyon Dam Area

Vegetation Type	Perennials (lbs/acre) 1974	Perennials (lbs/acre) 1975	Annuals (lbs/acre) 1975	Annuals (lbs/acre) 1976
Riparian	3,250	2,708	5,265	273
Sagebrush-Greasewood	1,667	1,466	456	189
Shadscale	1,163	1,165	2,002	34
Juniper	2,247	1,189	34	2.2

Source: VTN Colorado, Inc. 1977.

TABLE 3-7
Raptors Found in the White River Dam Project Area From 1975-1979

	Habitat Preference[a] Nesting	Habitat Preference[a] Foraging
PERMANENT RESIDENTS		
Sharp-shinned Hawk	U, R	U, R
Cooper's Hawk	R	R, U
Red-tailed Hawk	U, R	U, R
Golden Eagle	U, R	U, R
Northern Harrier (Marsh Hawk)	U	U
Prairie Falcon	U	U
Great Horned Owl	R	U, R
Burrowing Owl	U	U
Long-eared Owl	R	U, R
Short-eared Owl	U	U, R
SUMMER RESIDENTS		
Turkey Vulture	R	U, R
American Kestrel	U, R	U, R
WINTER RESIDENTS		
Goshawk	R	R, U
Rough-legged Hawk	U, R	U, R
Bald Eagle	R	R, U
TRANSIENTS		
Swainson's Hawk	U	U
Ferruginous Hawk	U	U
Peregrine Falcon	R	R
Merlin	R	R

Sources: Behle and Perry 1975b, Grant et al. 1980, Smith and . Associates, 1979, VTN Colorado, Inc. 1977.

[a]U = Upland habitats, includes shadscale, sagebrush-greasewood, and juniper; R = riparian.

may prove to be a new species of *Penstemon* was discovered in June 1980 by BLM, Vernal District. Populations within the proposed White River Reservoir, as well as outside the project area in Evacuation Creek, have been located. This *Penstemon* is not presently listed as a threatened or endangered species. Additional information concerning its taxonomy, population status, and distribution is needed before its rareness can be evaluated.

WILDLIFE

Terrestrial Wildlife

There are two major groups of wildlife in the White River Dam area: true desert fauna adapted to an arid environment and fauna requiring access to surface water. The latter group are the most numerous and diverse. Distinct distributional patterns corresponding to vegetation type are evident for each group.

MAMMALS

A total of 69 species of mammals have been found in the region. Their habitat preference and abundance are summarized in Appendix 5, Table A. Sixty-one species of game and nongame mammals are known to utilize the project area. These include 24 species of rodents, 16 species of carnivores, 14 species of bats, 4 species of rabbits and hares, and 3 ungulate (hoofed mammals) species.

Desert cottontails are the most numerous game mammal in the project area, occurring as high as 6,300 feet (1,919 m). They occur in all habitat types and are most abundant in the sagebrush-greasewood type. However, during low abundance they maintain their population along the White River (Grant et al. 1980).

The cottontails, chipmunks, mice, and woodrats provide the most stable prey base for carniverous mammals, birds, and reptiles in the project area. Upland shadscale and sagebrush-greasewood habitats support more rodents and cottontails in normal years than do the riparian habitats. But during drought conditions, small mammal numbers decrease dramatically in the upland areas while being maintained in riparian habitat. Following a drought, the upland areas are repopulated from the riparian population (Grant et al. 1980).

The riparian habitat also supports a beaver and porcupine population. Based on abundance estimates through 5 years (Grant et al. 1980), at least 176 beaver and 26 porcupine live along the stretch of river which the reservoir would inundate. Muskrat in the project area occur rarely.

The most numerous carnivores occurring in the project area are the coyote, badger, and striped skunk. Gray fox, ringtail, raccoon, and bobcat are uncommon to rare. Nine other carnivores occur in the region but not in the project area. The black bear, long-tailed weasel, and mountain lion are considered wanderers in the project area.

Mule deer are encountered in all habitat types. The riparian habitat on the White River is the focal point of deer activity from spring through fall. There are approximately 7,600 deer in the Book Cliffs Herd Unit which includes the project area. Estimated abundance of deer for the area which would be covered by the White River Dam and Reservoir ranges as high as 150 to 250 from 1975 to 1977 and as low as 75 to 150 from 1978 to 1979. Discussion with the Utah Division of Wildlife Resources (UDWR) (Drobnick 1980a) concerning deer abundance resulted in establishing the number 200 to represent the normal deer population of the proposed White River Reservoir basin (this represents approximately 2.6 percent of the Book Cliffs Herd Unit). The riparian habitat is critical for does who spend most of their fawning and nursing periods along the river corridor. Fawn production along the river is high for the Book Cliff Resource Area (VTN Colorado, Inc. 1977). The bucks occur in the uplands near the river.

The deer move up the side canyons on the White River or out onto the benches to browse and return to the river bottom and side canyons during the day. The river bottom is not used by deer during the winter due to cold air drainage and shading from the canyon walls. Major wintering areas adjacent to the White River are depicted in Figure 3-7, based on ground observation (Grant et al. 1980) and telemetry studies by UDWR personnel (VTN Colorado, Inc. 1977).

Pronghorn antelope are found north of the White River to Blue Mountain, the northeastern border of the Uinta Basin. Although Smith and Associates (1979) depict their distribution south of the White River, none have been sighted in this area (Grant et al. 1980, Olsen 1973, Ranck 1961). These antelope confine their activity to the bench areas and were only sighted along the White River during the 1977 drought (Grant and Kung 1979). Fawning grounds for pronghorn antelope cover an estimated 38,000 acres (15,378 ha). The area which would be traversed by the Green River Pipeline (Alternatives

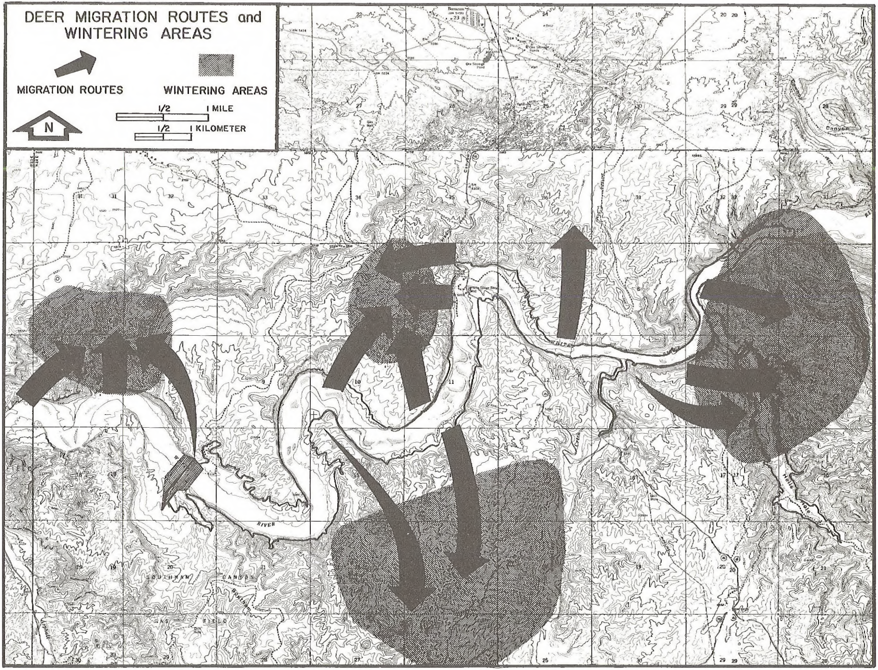


Figure 3-7
WINTERING AREAS FOR MULE DEER ALONG THE WHITE RIVER
Source: VTN, Inc. 1977

4 and 5) is a critical fawning area (Smith and Associates 1979).

BIRDS

Habitat preference and abundance of birds in the project area is summarized in Appendix 5, Table B.

There are 186 species of nongame birds in the general region of the White River Dam. Forty-eight species of these birds have been found exclusively on the Green River and its wetlands. From direct observation and published accounts, 138 nongame bird species have been encountered in the project area.

There are 21 species of raptors in the general region with the osprey (Behle and Perry 1975b) and the screech owl (Twomey 1942) found on or near the Green River. The remaining 19 species of raptors are found in the project area (Table 3-7).

Of the 12 permanent and summer resident raptors, 8 nest in both riparian and upland habitats and four raptors nest exclusively along the White River. Nine of these raptors hunt in both upland and riparian habitats. The Cooper's hawk prefers hunting in riparian habitats. The other raptors prefer hunting uplands, that is, shadscale, sagebrush-greasewood, and juniper habitats, since these areas can support a greater prey base and are more open (more bare ground within the plant community). However, when weather conditions changed from a good water year in 1975 to drought in 1977 and subsequent low prey base in the uplands in 1978 and 1979, the riparian habitat became a focal point for raptor activity. The most abundant raptors in this group are the red-tailed hawk, golden eagle, great horned owl, turkey vulture, and American kestrel.

Of the three winter residents, the goshawk and bald eagle are uncommon and prefer the riparian area along the White River. The rough-legged hawk is common in the bench area north of the White River where the pipelines would be constructed. This hawk is uncommon to rare along the White River. The four transients (Table 3-7) occur at rare abundance in the project area. It may be that the ferruginous hawk nested in the bench areas north of the White River (Smith and Associates 1979).

The other 119 nongame bird species occurring in the project area are primarily passerines (perching, songbird types). All but 10 of these species depend on the White River for nesting, foraging, water, or migratory rest stop. Twelve of these nongame birds which have occurred consistently through 5 years (three permanent residents, eight summer residents and one transient) are obligates to the riparian habitat (i.e., they are found exclusively along the White River) (Grant et al. 1980).

Twenty-seven species of game birds occur in the project area: 21 species of waterfowl, four upland species, one shorebird, and one dove. The Canada goose is the only waterfowl species nesting and rearing young along the White River. Mallards and green-winged teal are frequent transients and may have nested along the White during the 1977 drought. Gadwall, pintail, blue-winged teal, cinnamon teal, American widgeon, northern shoveler, and common mergansers use the river as a migratory stopover.

Upland game birds include sage grouse, California quail, ring-necked pheasant, and chukar. The quail are found along the Green River, Ashley Creek, and irrigation canals near Vernal, Utah. Sage grouse were found in the desert shrub north of the White River (Smith and Associates 1979). Their main concentration occurs on Blue Mountain (approximately 40 miles northeast of the project area) (Twomey 1942). Chukars, which were planted along the White River (Olsen 1973), have since disappeared from the river drainage. One chukar was recently seen near Hell's Hole Canyon (Grant and Kung 1979), indicating the possibility of a small population in this drainage. Ring-necked pheasants are concentrated in the agricultural sections of the basin from Duchesne to Vernal. Olsen (1973) reports sightings at Ignatio Stage Stop along the White River, and Grant and Kung (1979) reported one hen and one cock in Wagon Hound Draw and Cowboy Canyon, respectively.

One shorebird, the common snipe, is an infrequent transient on the White River. Mourning doves, on the other hand, are common summer residents, nesting in the desert shrub and juniper woodlands and watering at the White River and scattered stock ponds and reservoirs.

THREATENED, ENDANGERED, AND SENSITIVE BIRD SPECIES

There are three endangered birds residing in or visiting the White River Dam area: the whooping crane, the peregrine falcon, and the bald eagle. During the fall migration in 1976, one whooping crane was sighted flying south over the White River in the company of approximately 300 sandhill cranes, and they are reported occasionally in the Vernal-Jensen area. (About 20 whooping cranes probably use this flyway (Drewein 1980).) These cranes are most likely birds experimentally raised at Gray's Lake, Idaho and migrate to New Mexico with their sandhill crane foster parents. Their occurrence in the area would be limited to the riparian habitat

and usually in the presence of sandhill cranes. Whooping cranes use the Green River bottoms and other bodies of water from Vernal to the mouth of the White River as the only rest stop between Grays Lake and the San Luis Valley of Colorado (Drewein, 1980). Although whooping cranes could thus be present in the project area, the probability of whooping cranes using the White River bottoms in Utah is low.

Confirmed sightings of the peregrine falcon occurred in April and August, 1975. The spring sighting was made in Wagon Hound Canyon north of the White River. The summer sighting occurred near the proposed dam site on the White River. This latter sighting strongly suggests that the falcon nested somewhere in the region. There are ample nest sites of prey birds in the sandstone cliffs near the river and, in 1975, avian prey abundance was at its peak (Grant and Kung 1979).

The bald eagle is a consistent winter resident along the White River, ranging from east of Meeker, Colorado, to Ouray, Utah. The eagles hunt along the river and in the adjacent shadscale habitat as far north as Bonanza, Utah, and along Evacuation Creek to the south. Peak abundance in the riparian habitat occurred in 1979 at 0.8 eagles per mile (0.5/km). The number of bald eagles which use the river within or near the proposed White River Dam Reservoir ranges from 3 to 10 during the winter. In the field survey for bald eagles in April 1980, 15 were sighted along the White River from the Colorado-Utah state line to Asphalt Wash located a few miles downstream from the proposed dam site (Wagner 1980).

Two birds of Federal and State interest (sensitive species) occur in the area. At least one pair of Scott's oriole nested in the juniper woodlands and foraged in desert shrub south of the proposed dam site from 1975 to 1977 (Grant and Kung 1979). A few western bluebirds migrate through the area and occur primarily along the White River (Grant and Kung 1979).

Aquatic Wildlife

WHITE RIVER

The potential area of impact on the White River by the proposed White River Dam and alternatives extends from the Utah-Colorado border to its confluence with the Green River near Ouray, Utah. Aquatic studies in the White River basin have been fairly intensive in Colorado. Studies in the Utah section have been sporadic and of low intensity, although the most recent study (Lanigan and Berry 1979) concentrated on the fishes in the reservoir basin and below.

The White River is a typical Colorado basin desert stream. The upper headwaters are clear, cool trout habitat, whereas the lower section is a turbid, warm desert stream. The aquatic biota of these two portions of the river are considerably different, due to different physical-chemical parameters.

The biota of the lower White River will be discussed in terms of producers and consumers:

1. Producers: The basic source of energy to the food chain, primarily plant material;

2. Consumers: Macroinvertebrates (the insects and other life forms inhabiting the stream bottom) and fishes.

The producers in the lower White River are various species of algae that grow attached to the rocks, primarily in riffles. They are collectively called periphyton and are generally in low abundance in this section because of high turbidities reducing light penetration, high levels of scour due to a shifting sand bottom, and relatively few riffles. Periphyton density usually increases in late summer when flows are low and clearer (Holden and Selby 1979a, Hynes 1970). As is typical of rivers, no true plankton community grows in the White River. Macrophytes (rooted aquatic plants) are scarce in the White River due to turbidity and scour. Holden and Selby (1979a) noted dense clumps of narrow leaf pondweed (*Potamogeton sp.*) near Rangely, Colorado. They found small, scattered clumps in areas of low velocity with a silt substrate. Because of this lack of instream plant production, detritus (organic material washed in from the surrounding terrestrial community) serves as the major source of plant material for the stream ecosystem.

The macroinvertebrate community of the lower White River is also rather poor, for the same reasons mentioned above for periphyton (Baumann and Winget 1975). Macroinvertebrates reach their greatest abundance in riffles (Hynes 1970), so the low number of riffles in the project area reduces the potential for large macroinvertebrate populations. The species present often represent remarkable adaptations for living in the harsh, desert stream they inhabit. Holden and Selby (1979a) found eight species of mayflies to be the most abundant macroinvertebrates in riffles in the White River near Rangely, Colorado.

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Fishes

Appendix 5, Table C, lists the 15 fish species found in the Utah section of the White River by recent investigators and notes their relative abundance and reproductive status. Of the fishes collected in the White, seven are native, the other eight introduced.

The introduced red shiner is the most abundant fish in the White River of Utah, but native species are also common (speckled dace, roundtail chub, flannelmouth sucker) and reflect the natural state of the river habitat.

Most of the native species utilize slow water areas (backwaters, eddies) when they are young, but prefer eddies and runs as they grow older. Reproduction for most native species probably occurs in the riffles, although detailed spawning data is not available. Many of the exotic species, especially the minnows, reproduce in slower areas and spend most of their lives in that habitat.

Channel catfish is the only species fished for in the project area, and relatively few fishermen seek this species.

Threatened, Endangered, and Sensitive Fish Species in the White River

Three endangered fishes have been found in the White River (Figure 3-8). One specimen of the humpback chub (*Gila cypha*) and one of the bonytail chub (*Gila elegans*) have been collected (Smith and Associates 1979). Another member of the humpback chub-bonytail chub complex (Holden and Stalnaker 1970) was collected in 1979 by Lanigan and Berry (1979). Neither of these species appear to utilize the White River except on rare occasions. Their habitat preferences are for large rivers and areas of fairly swift current (Vanicek and Kramer 1969, Holden and Stalnaker 1975, Holden 1979).

Colorado squawfish (*Ptychocheilus lucius*) have been reported in the White River by local residents for a long time. The first published listing of squawfish from the White River was by Everhart and May (1973), who captured several in Colorado near the mouth of Piceance Creek. Carlson et al. (1979) caught two adults from the same general areas of the White River in 1979. Lanigan and Berry (1979) captured eight squawfish from the Utah section of the White River downstream from the proposed White River Dam in 1978 and 1979. All of the fish documented from the White River were subadult to adult fish; no young-of-the-year or juveniles have been found.

A radio telemetry study of adult squawfish conducted during late spring and summer of 1980 by the USFWS noted several occurrences of their monitored fish moving up the White River (USDI, USFWS 1980). This data further substantiates use of this tributary stream.

The general life history requirements of Colorado squawfish are not well known. Recent studies have shown that they spawn in the Green River below Jensen, Utah (Holden and Stalnaker 1975, Holden 1979, Holden and Crist 1979, Holden and Selby 1979b). They prefer quiet backwater areas when they are young, but use various habitats as they grow older (Holden 1979, Holden and Selby 1979b). Although considered "large river" fish, squawfish have been found in all major tributaries of the Colorado River system, including the White, Duchesne, Yampa, and Dolores (Joseph et al. 1977). The reason for use of tributaries such as the White is not clear. No young rare fish have been found in tributaries; therefore, it is assumed that spawning does not occur in this stream. Holden and Selby (1979a) suggest that the tributaries may provide an abundant, natural food source for larger, fish-eating adults, resulting in seasonal or sporadic use of the tributaries.

The USFWS expects to conduct an additional year's study of the endangered fishes and their habitat within the White River drainage. Field investigations would begin during the fall of 1980 and conclude in October 1981.

Neither the habitat requirements of the Colorado squawfish nor some other environmental influences on this rare species are fully understood by aquatic ecologists; hence the need for additional studies.

As noted previously the State of Utah currently has requested that the consultation processes with the USFWS be continued. Therefore, the Biological Opinion of the USFWS has not been received by the BLM for consideration and incorporation in this Draft EIS.

GREEN RIVER

The potential area of impact on the Green River by the proposed White River Dam and alternatives is from the mouth of Walker Hollow to the Green's confluence with the Colorado River.

This area includes two major types of habitat: a slow, meandering run with very few riffles and primarily a shifting sand substrate, and a canyon area with steep gradient, swift current, rapids, and riffles interspersed with runs and cobble and boulder substrate along with areas of sand. This latter habitat is in Desolation Canyon, about 50 miles (80 km)

below the mouth of the White River (Figure 1-1). The slower sections include the area from Walker Hollow to Desolation Canyon and from Green River, Utah, to the confluence with the Colorado River. A number of studies have recently been completed on the fishes in these portions of the Green River (Holden 1979, Holden and Crist 1979, 1980), and the USFWS is presently completing an intensive study of Colorado squawfish and humpback chub. A recent study by Holden and Selby (1979b) summarized much of the fishery work to date and also investigated other parts of the aquatic ecosystem.

The producer and macroinvertebrate communities of the Green River are similar to those of the White. Few plankton and macrophyton are found. Periphyton is limited in most of this area due to few riffles, except in Desolation Canyon. Abundance of periphyton is low in spring and high in summer (Holden and Selby 1979b).

Holden and Selby (1979b) took macroinvertebrate samples from cobble areas along shorelines between Walker Hollow and Ouray, Utah. Density of invertebrates was fairly low and the community was composed primarily of mayflies, midges (*Chironomidae*), and caddisflies. More slow water forms were noted than found in areas with more prominent riffles and swifter currents.

Fishes

Appendix 5, Table D, lists the fishes that have been caught in several recent studies in the Green River below Walker Hollow and indicates their relative abundance and reproductive status. The fishery population is dominated by the introduced red shiner, which comprised 63 percent of the catch by Holden and Selby (1979b). Carp and fathead minnows are also common introduced species. The most common native species are flannelmouth sucker, bluehead sucker, and speckled dace.

Use of various habitats by different species of fish is discussed briefly by Holden and Selby (1979b). Reproduction and habitat use is generally the same as in the White River (i.e., slower areas are used by fish when young and more of the river proper is utilized as the fish mature).

Channel catfish is the major species fished for in the project area, and relatively few fishermen seek this species.

Threatened, Endangered, and Sensitive Fish Species in the Green River

Three endangered fishes, Colorado squawfish, humpback chub, and bonytail chub, and a protected species by the States of Utah and Colorado, the razorback sucker (*Xyrauchen texanus*), inhabit the Green River (Figure 3-8).

Reproduction of Colorado squawfish is known to occur throughout the affected area (from the mouth of Walker Hollow to the Green River's confluence with the Colorado River) which also contains the largest remaining adult population (Holden and Stalnaker 1975, Holden and Selby 1979b). Habitat preferences of squawfish were discussed in the White River section.

A large, reproducing population of humpback chubs inhabit Desolation Canyon of the Green River (Holden 1979). This species prefers deep, swift areas of canyons although it is occasionally found in slower, noncanyon areas.

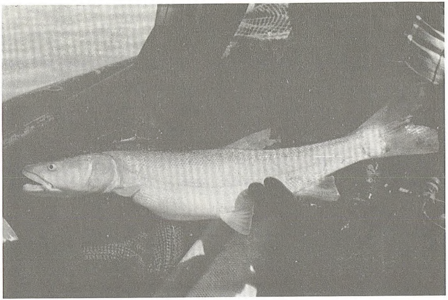
The bonytail chub is very near extinction and was recently listed as an endangered species through emergency listing procedures. Recent collections in the Green River have either failed to find this species or have found only one or two individuals (Holden 1979, Holden and Selby 1979b). Suttkus and Clemmer (1977) collected a juvenile bonytail near the town of Green River, Utah. Holden (1979) found one in Desolation Canyon.

Razorback suckers are also found throughout the area. Adults are fairly common; juveniles have only been reported once (Holden 1979). The razorback is generally found in quiet, backwater areas, although Holden and Crist (1980) found a few in riffles in late summer. The lack of juveniles is perplexing because razorbacks have been found in spawning condition in the upper basin (McAda 1977), and adults can be rather common in some areas. The juveniles are similar in appearance to young flannelmouth suckers, an abundant native species. Perhaps the identity problem has artificially created the low catch success of young razorbacks.

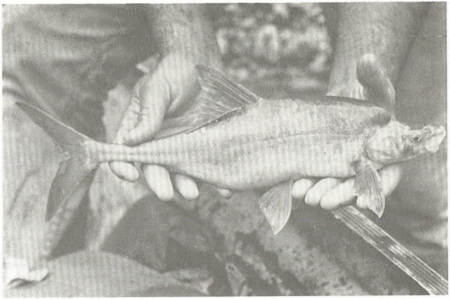
RECREATION

Regional Setting

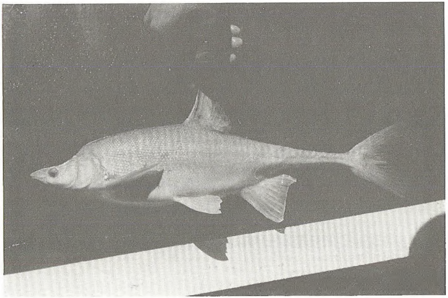
The five most frequently engaged-in outdoor recreation activities by residents of the Uinta Basin are, in order of preference, fishing, driving for



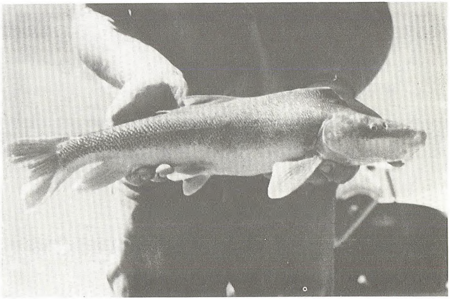
Colorado squawfish (*Ptychocheilus lucius*)



Humpback chub (*Gila cypha*)



Bonytail chub (*Gila elegans*)



Razorback sucker (*Xyrauchen texanus*)

Figure 3-8
RARE FISH OF THE GREEN AND WHITE RIVER SYSTEMS

pleasure, camping, big game hunting, and swimming. These activities fall in much the same rank order for all residents of the State of Utah (Institute of Outdoor Recreation and Tourism 1978). The vast majority of outdoor recreation activities participated in by Uinta Basin residents take place in the basin (see Table 3-8).

Ninety-five percent of the fishing occurs in the streams, small lakes, and reservoirs within the basin, as well as in Flaming Gorge National Recreation Area. These areas are mainly cold water fisheries for rainbow and brown trout.

Warm water fishing (bass, bluegill) is available at Pelican Lake which is located approximately 24 miles (39 km) east and south of Vernal. The reservoir has been described as the best bluegill fishery in the State of Utah (Burdick 1979). The reservoir is fished year round and averaged 7,700 angler days use per year from 1973 through 1977 (Burdick 1979).

Major outdoor recreation sites within the Uinta Basin include Flaming Gorge National Recreation Area, Dinosaur National Monument, the High Uintas Primitive Area, and the Ashley National Forest. Portions of all, with the exception of Flaming Gorge, include proposed wilderness. Developed recreation facilities at these locations and their use are summarized in Table 3-9.

Due to the high percentage of public land, the vast majority of land within the region is available for dispersed outdoor recreation including hunting, fishing, sightseeing, backpacking, camping, picnicking, and ORV use. The higher elevations, especially portions of the Ashley National Forest are available for cross country skiing and snowmobiling. Boating occurs at Flaming Gorge National Recreation Area and several smaller reservoirs as well as portions of the Green River. The Yampa River and the Green River below Flaming Gorge Dam, in Dinosaur National Monument, and in Desolation and Gray Canyons, provide opportunities for whitewater boating.

Vernal and Roosevelt have active municipal recreation programs. Vernal has recently constructed a community recreation center.

Project Area

At present there is limited, highly seasonal outdoor recreation occurring along or on the White River in Utah. There is no monitoring of that use. Hunting is limited to the fall, and water-oriented activity is limited primarily to the late spring and early summer. An analysis of this activity follows.

WATER-ORIENTED ACTIVITIES

Fishing

Limited fishing for channel catfish occurs in the White River in Utah. There are no estimates of fishing use.

Canoeing and Rafting

Limited canoeing and rafting occurs in the White River in Utah in late spring and early in summer during runoff. Rugged scenery, relative abundance of wildlife, and remoteness attract recreationists. While there are no use figures available, estimates run to fewer than 20 parties per year within the project area. Parties typically launch their craft at the Ignatio Bridge. Three to five of these are engaged in float hunting for deer downstream from the project area.

LAND-ORIENTED ACTIVITIES

Camping

Limited camping occurs in the project area, apparently in conjunction with other outdoor recreation activities. Camping near the river occurs most often at Ignatio.

ORV Use

ORVs (motorcycle, 4-wheel drive) are used occasionally in the project area primarily to gain access to the river. There are no ORV use estimates for the area.

Driving for Pleasure

Although there are no data, there is probably some pleasure driving within the project area, mostly associated with Utah Highway 45 and the Ignatio Stage Stop.

TABLE 3-8

Outdoor Recreation Participation
by Residents of the Uinta Basin
and All Utah Residents, 1976-1977

	Uintah Basin Residents			All Utah Residents	
Activity	Rank Order	Activity Occasions	Amount of Occurrence in Region	Rank Order	Activity Occasions
Fishing	1	162,200	95	2	23,248,600
Driving for Pleasure	2	138,300	75	3	21,607,800
Camping	3	127,600	90	1	76,984,600
Big Game Hunting	4	94,800	80	4	15,769,000
Swimming	5	90,000	95+	7	8,883,600
Bicycling	6	75,800	95+	10	7,550,100
Picnicking	7	74,700	85	5	9,775,500
Horseback Riding	8	70,800	95	16	4,887,500
Unstructural Play	9	70,500	95+	9	7,677,300
Basketball	10	66,700	95+	12	5,998,700
Hiking/Backpacking	11	57,500	90	11	7,281,100
Baseball	12	42,500	95+	17	4,511,700
Exercise/Gym Activities	13	42,500	85+		
Hunting, Other	14	38,500	85	8	8,482,800
Spectator Sports	15	36,000	85	13	5,925,800
Power Boating	16	29,200	95+	18	4,365,400
Motorcycle Activities	17	27,600	95+	20	3,059,400
Playground Activities	18	27,600	80	25	2,336,800
Golf	19	27,100	95+	6	9,572,000
Tennis	20	24,400	95+	15	5,689,400
Skiing, Downhill	[a]			14	5,807,100
Fairs/Amusement Parks	[a]			19	3,104,800

Source: Utah Resident Outdoor Recreation Participation 1976-1977. Institute of Outdoor Recreation and Tourism, Utah State University.

[a]Not in top 35 activities.

TABLE 3-9

Major Outdoor Recreation Sites Within the Uinta Basin

Administering Agency	Site	Opportunities	County
National Park Service	Dinosaur National Monument	Fossil excavations, camping, sightseeing hiking, river rafting, Island Park Game Management Area.	Uintah
U.S. Forest Service	Ashley National Forest	Flaming Gorge National Recreation Area, High Uintas Primitive Area, Sheep Creek Canyon Geologic Area, Camping, hiking, boating, river rafting, hunting, fishing, snowmobiling, cross country skiing.	Daggett, Duchesne, and Uintah
Bureau of Land Management	Desolation and Gray Canyons	River rafting.	Uintah
	Drive Through the Ages	Geology, sightseeing.	Uintah
U.S. Fish and Wildlife Service	Browns Park	National Wildlife Refuge.	Daggett
	Ouray	National Wildlife Refuge.	Uintah
Utah Division of Parks and Recreation	Starvation Lake State Beach	Camping, fishing, boating.	Duchesne
	Steinaker Lake State Recreation Area	Camping, fishing, boating.	Uintah
	Big Sand Lake State Beach	Camping, boating.	Daggett
Other	Bottle Hollow Resort	Fishing, boating.	Uintah
	Pelican Lake	Fishing.	Uintah
	Montez Creek Reservoir		Uintah

Source: Hunt and Dalton, 1976.

Hunting

There is little upland game hunting along the White River in Utah. Limited hunting for mourning doves along the White River and for chukar partridge in Hell's Hole Canyon may occur.

The desert cottontail rabbit and mountain cottontail occur in the riparian habitat and higher elevations, respectively. There is some limited rabbit hunting in the area, estimated to be less than 50 hunter days. (A hunter day equals one person hunting all or any part of a day.)

Some deer hunting occurs in the project area (less than 100 hunter days due to limited access and nearby hunting areas of higher quality).

Limited hunting for pronghorn antelope occurs along the Green River Pipeline route, an alternative project.

Some waterfowl hunting occurs along the White River in Utah. The Green River is located closer to population centers in Utah and receives the majority of waterfowl hunting pressure in the region. Most waterfowl in the project area nest and move from the area before the hunting season. A liberal estimate of waterfowl hunting in the project area is 20 hunter days.

VISUAL RESOURCES

The site of the proposed White River Dam and associated reservoir is located along the southern border of the Bonanza Planning Unit near Bonanza, Utah.

Scenic Quality

Flores Associates (1979) classified the scenery along the White River in the project area as Class A or the highest category. This classification was assigned because of the vegetation, wildlife, and uniqueness of the landform. Most of the Class A scenery within the region occurs along the White River and its side canyons. The most predominant landforms along the river in the Class A scenic area have been identified as being the "interesting rock formations, ranging from erosion-sculpted rock crests to tall spires, with both high vertical relief, and low bluffs and rolling hills." The river itself has been identified as being scenically important as well.

Visual Zones

The White River section which could be affected by the White River Dam and Reservoir has been identified as being in the foreground/middleground (Flores Associates 1979). This means the area along the river may be seen only from locations fairly close to the river itself. The current primary access for sightseeing is Utah Highway 45.

Visual Sensitivity Levels

The White River and its canyon walls were classified as an area of medium visual sensitivity due to its potential as an accessible attraction for sightseers by Flores Associates (1979).

Visual Resource Management Classes

Of most importance was the assigned Class II visual resource management classification given the White River and its surrounding bluffs (Figure 3-9), the highest classification given to any portion of the Bonanza Planning Unit. This results from the area's undisturbed nature (Flores Associates 1979).

The visual resources along the route of the proposed Green River Pipeline are low quality except near the Green and White Rivers. The scenic quality is mainly Class C, sensitivity levels are low, the visual resource management classification is IV and V, and distance zones are foreground and background. (See Appendix 6 for visual resource class definition.)

LAND USES, PLANS, AND CONTROLS

Uses

There is currently only limited human use of the White River and its associated canyons. There are no permanent residents nor cropland in the area.

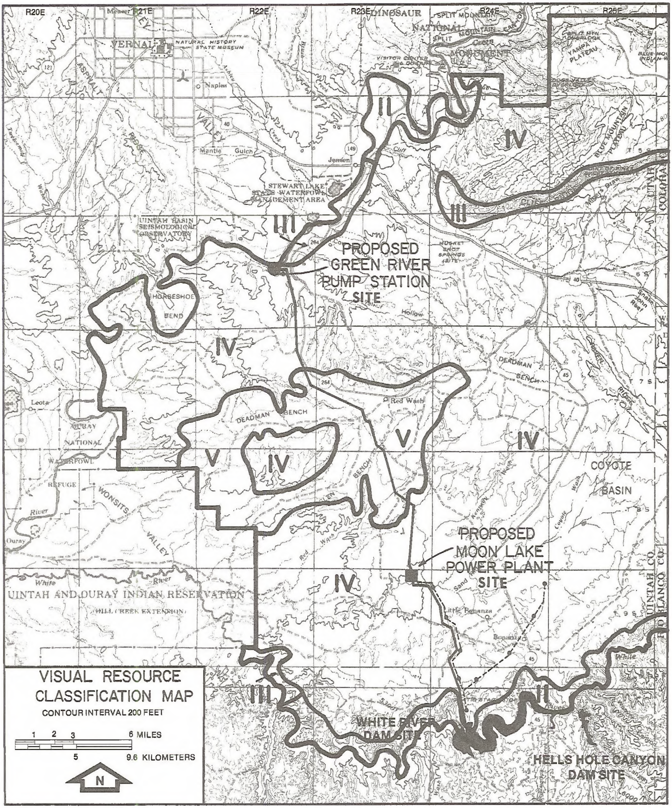


Figure 3-9
VISUAL RESOURCE CLASSIFICATION MAP
Source: Flores Associates Inc.

DOMESTIC LIVESTOCK GRAZING

Table 3-10 lists the 14 BLM grazing allotments in the project area. They are also shown in Figure 3-10. The allotments are for both sheep and cattle with most of the use occurring in winter and early spring. Additional grazing on private lands along the White River also occurs in the project area.

WILDERNESS

The project area was studied for wilderness characteristics by BLM but was released in August 1979 from further inventory because it lacked wilderness characteristics according to established criteria.

WILD HORSES

Wild horses are found north of the White River and in a small area south of the river (Smith and Associates 1979). None have been encountered along the White River since 1974 (Grant et al. 1980), apparently because of stock ponds and reservoirs established after that time north of the river. The BLM estimates there are 34 wild horses which inhabit the bench area along the Green River Pipeline Alternative.

Land Use Plans

BLM

The White River Dam, reservoir, power plant and associated power transmission system, recreational facilities, and access roads are located within the area under the BLM Bonanza MFP (1974) which guides public land uses in Uintah County. Each alternative in this EIS is included under the same MFP.

The MFP calls for several items:

1. A detailed land use plan and environmental study before any major residential or industrial development takes place on oil shale discoveries;

2. New transmission lines to be placed in existing or planned corridors whenever possible with lines that blend with the natural environment;

3. No allowance of incompatible uses or developments on or adjacent to inventoried archaeological sites;

4. Preservation of open space and restriction of surface disturbances and man-made improvements which would detract from the natural environment and scenic quality of the area;

5. Exclusion of ORV use adjacent to the White River.

OTHERS

Development in Uintah County is governed by county zoning ordinances (1971) and the Uinta Basin Development Plan (1979) prepared by the Uinta Basin Association of Governments. The White River Dam and Reservoir and all proposed alternatives are within areas presently zoned for mining and grazing.

CULTURAL RESOURCES

Archaeological Resources

Prehistoric cultural resources which have been recorded in the Uinta Basin of northeastern Utah indicate a sporadic but fairly continuous human occupation of the region for the past 10,000 years. Previous archaeological surveys and excavations undertaken in the area indicate the potential for remains of several cultural groups in the vicinity of the proposed project. Included here are cultural evidences for the Paleo-Indian "big game" hunters (ca 6,000-10,000 BC), Archaic age hunter-gatherers (ca 2,500 BC-AD 350), Fremont agriculturalists (ca AD 950-1,200), protohistoric Ute and Shoshoni hunter-gatherers, and Euro-American homesteaders and miners.

Several cultural resource surveys have been conducted in the vicinity of the proposed White River Dam Alternatives (Berry and Berry 1975, Chandler and Nickens 1979, Nickens 1980, Larralde and Nickens 1980). As a result of these inventories, much of the area included within the proposed alternatives has been surveyed for cultural resources. There are some areas, however, which have not been evaluated. These areas include the proposed reservoir area upstream from the vicinity of the Ignatio Stage Stop and a portion of the route of the Green River to White River Pipeline Alternative which extends from the Bonanza Power Plant site

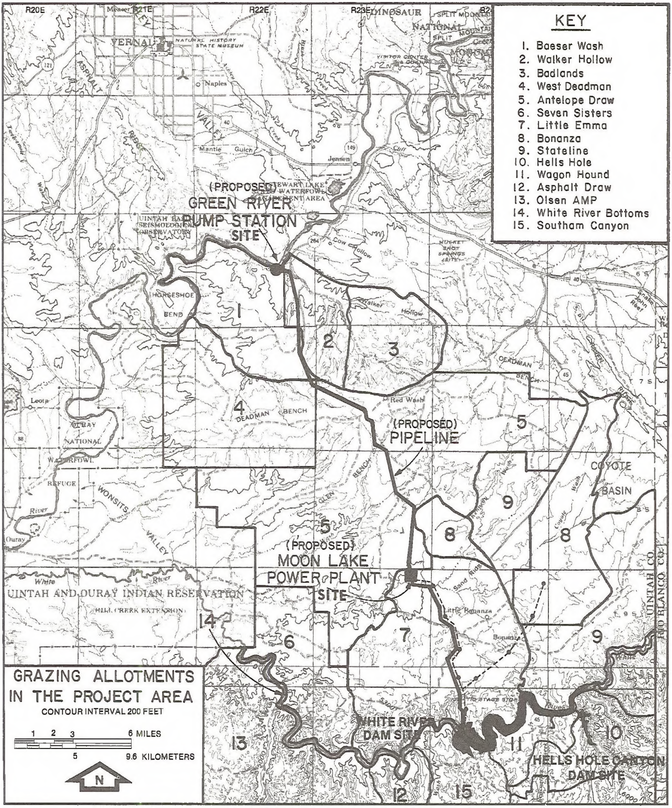


Figure 3-10
GRAZING ALLOTMENTS WITHIN THE PROJECT AREA
Source: Bureau of Land Management 1980

TABLE 3-10
Grazing Allotments Within the Area of the Proposed Project and the Alternatives

Grazing Allotment	Number and Class Livestock	Season of Use	Animal Unit Months (AUMs)	Allotment Range Condition
Asphalt Draw	4,653 Sheep	3/1 to 4/20	1,551	Fair
Olsen AMP	7,835 Sheep	12/1 to 4/30	7,835	Fair
Bonanza	2,000 Sheep	3/1 to 4/30	800	Fair
Walker Hollow	403 Cattle	11/15 to 1/11	766	Fair
Badlands	240 Cattle	4/6 to 5/10	280	Poor
	210 BLM		245	
	30 Private		35	
Antelope	7,015 Sheep	3/1 to 3/31	1,403	Good
Baeser Wash	1,655 Sheep	3/1 to 4/25	608	Good
	1,437 BLM		528	
	218 Private		80	
White River Bottoms	175 Cattle	6/1 to 10/15	788	Good
	106 BLM		477	
	69 Private		311	
Seven Sisters	1,920 Sheep	11/14 to 4/15	1,920	Poor
Stateline	3,745 Sheep	3/1 to 4/24	1,348	Fair
	2,516 BLM		906	
	1,222 Private		442	
Hell's Hole	6,093 Sheep	1/1 to 4/15	1,865	Fair
	2,664 BLM		534	
	3,430 Private		1,331	
Wagon Hound	8,013 Sheep	1/1 to 4/20	1,650	Fair
	5,000 BLM		840	
	3,013 Private		810	
West Deadman	8 Cattle	7/16 to 8/30	12	Good
	700 Sheep	3/10 to 4/30	238	
Little Emma	4,554 Sheep	3/1 to 4/30	1,822	Fair

Source: Evans, 1980.

TABLE 3-11
Known Cultural Resources Associated With Project Alternatives

Project Component/ Alternative	Total Number of Known Sites	Eligible to the National Register
Alternative 1[a]	24	1
Alternative 3[b]	0	0
Alternatives 4 and 5[c]	2	0

[a]Berry and Berry 1975, Larrolde and Nickens 1980.

[b]Nickens 1980.

[c]Chandler and Nickens 1979.

southward to the Green River. Also, historic Euro-American homesteads are reported in the vicinity of the proposed White River Dam which have not been formally recorded nor evaluated (Tucker 1980).

Previous cultural resource surveys have recorded 26 cultural resource sites within or proximal to the proposed project area boundaries (Table 3-11). Twenty-one of these sites are found at the White River Dam and Reservoir location, three from the borrow areas north of Bonanza, and two are located along the proposed Green River Pipeline route. Prehistoric lithic scatters consisting of stone artifacts and indicative of short-term, limited use occupations form the largest category of known cultural resource occurrences.

Historical Resources

Only one historic site has been formally recorded in the project area. This is the Ignatio Stage Stop, a component of the early twentieth century Uintah Toll Road between Dragon and Vernal. The stage stop consists of five buildings located on a small cliff overlooking the south bank of the White River. It was built about 1905 by the Uintah Railway and continued in use until 1935 when the railroad and toll road ceased to operate. None of these known cultural resource sites are currently listed on the National Register of Historic Places, although the Ignatio Stage Stop is a potential National Register candidate.

HUMAN RESOURCES

The impact area in Uintah County centers around Vernal, the county's largest city. Rangely in Rio Blanco County, Colorado, might also be slightly affected.

Uintah County's economy is based primarily on petroleum, gilsonite, phosphate, and forest products. Other industries include tourism, farming, and ranching.

POPULATION

The population of Uintah County has grown steadily from 12,684 in 1970 to about 19,310 in 1978 (Bureau of Economic and Business Research 1979), an increase of 52.2 percent, as compared to a 10-percent increase between 1960 and 1970. This increase is due primarily to energy industry expansion throughout the 1970s and represents a compound annual growth rate of 4.3 percent. The approximate population for Vernal in 1979 was 8,000.

ECONOMIC CONDITIONS

The principal manufacturing activities in the area, including lumber and wood products, food products, fabricated textile products, and chemicals, make relatively minor contributions to the economy. Without development of the oil industry and tourism, the area probably would have continued in a relatively static or declining economic state during the early to mid-1970s because the major industries of agriculture and gilsonite and phosphate mining were declining income industries. Personal agriculturally related income decreased 76 percent from 1973 to 1976, while total income increased 46 percent and mining income increased 52 percent, as a result of oil extraction.

In 1976, Uintah County had 18 manufacturing establishments, employing 287 people with a payroll of $2,563,000. Manufacturing employees comprise 5.1 percent of the total labor force in Uintah County, as compared to 14.0 percent for the state.

In 1978 there were 125 retail establishments in the Vernal area compared to 123 in 1972. Service establishments remained stable for the same 6-year period.

Moderate increases have occurred in the levels of total sales. In 1978 sales in the retail trade industry rose 16.7 percent compared to 1977. In the service sector, sales increased approximately 14.1 percent.

Financial Resources and Institutions

The principal sources of revenue in state government in Utah are an income tax and a 4.75-percent sales and use tax. At the city and county levels, property taxes provide the main source of revenue. Property taxes in Uintah County by all governmental units was $4,006,186 in 1977, an increase of 74 percent from 1970.

Vernal City government expenditures for the years 1976 through 1978 show a percentage increase in per capita expenditures of 16.5 percent. Uintah County expenditures show a percentage increase in per capita cost of 254.2 percent over the same 3-year period.

The Vernal area is served by three commercial banks and two savings and loan associations.

The financial resource base of the Uinta Basin is relatively limited, as is the case for most sparsely populated rural areas. However, the conventional oil boom has added significantly to private wealth, as well as to public sector revenues from sales and property taxes.

Family and Per Capita Income

Table 3-12 shows the median family and per capita incomes for Uintah County, as well as for the State of Utah. Median family income and per capita income in Uintah County are below the state level. However, percentage changes from 1970 to 1975 for per capita income indicate that Uintah County growth has been greater than that for the State of Utah.

Labor Force and Employment

Table 3-13 shows the labor force estimates for Uintah County and the State of Utah. As indicated by the table, county unemployment rates are lower than the state average. This trend is expected to continue if the area hosts economic growth including energy-related industry.

From 1970 to 1979, the total labor force in Uintah County increased 91.6 percent. Increased activity in conventional oil and gas exploration and production has resulted in rapid growth of employment in energy-related industry. Overall employment increased 13.1 percent between 1970 and 1976. Approximately 44 percent of the total labor force worked less than 250 days (less than the US Bureau of Labor standard of 260 days for full employment).

Housing

Recent residential construction has improved the overall housing profile for the region, but it has not met the need for additional housing generated by the existing oil industry.

Table 3-14 shows the year-round housing stock for Uintah County and Vernal between 1970 and 1976.

Factors contributing to the housing shortfall include: high construction costs, high mortgage rates, inadequate family income, transitory influx of construction and mining employment, and the risk associated with fluctuating populations in "boom town" situations. In fact, authorized new housing units reached a maximum in the 1972 to 1975 period and fell about 25 to 30 percent in 1976 to 1977. There are four new mobile home parks in Vernal with a capacity of approximately 118 spaces.

COMMUNITY SERVICES

Education

Selected data concerning the school system in 1977-78 are presented in Table 3-15.

The Uintah County School District has enrollments at almost all grade levels that exceed the system's designed capacity by 22.5 percent. The opening of a new elementary school having a capacity of 650 students in the fall of 1980 will bring the capacity of elementary schools up to expected enrollments. The district is projecting an increase of approximately 350 students by 1983-84.

Municipal Water Systems

The Vernal area water system has a storage capacity of 2.5 million gallons per day (mgd) and a deliverable capacity of 9 mgd. Peak demand is 8.65 mgd. The system has a conditionally approved state health rating pending corrective action which is currently underway.

To meet additional water needs, Vernal has access to the Red Fleet Dam and Reservoir. This reservoir could supply the Vernal area water system with 12,000 acre-feet of water for municipal and industrial use.

Throughout the district, potential sources of water supply are presently being investigated. Federal grant and loan funding or direct development by Federal agencies is anticipated. A bond proposal was passed in 1979 to upgrade the system and work is underway.

Municipal Waste Water Facilities

The City of Vernal has a waste water treatment plant with a capacity of 2.7 mgd and a design population equivalent of 7,500 people. The average daily flow is 1.7 mgd.

TABLE 3-12

Median Family and Per Capita Income for Uintah County and the State of Utah

	Median Family Income			Per Capita Income		
	Amount		Change	Amount		Change
	1975[a]	1970[b]	1975[a]-1970[b]	1975[a]	1970[b]	1975-1970[b]
Uintah County	$13,152	$8,082	62.7	$3,574 (4,257)	$2,234 (2,447)	+59.9
State of Utah	14,329	9,320	53.7	4,022	2,697	+49.1

Source: [a]U.S. Department of Commerce, Bureau of the Census, County and City Data Book 1977.

[b]U.S. Department of Commerce, Bureau of the Census, General Social and Economic Characteristics 1970.

[c]Utah Statistical Abstract 1979.

TABLE 3-13

Labor Force and Employment for Uintah County and the State of Utah

	Total Labor Force	Employed	Total Unemployed	Percent Unemployment (1979)	1977[a]
Uintah County	8,400	8,100	300	3.5	4.4
State of Utah	613,000	589,100	24,700	4.0	5.7

Source: Utah Department of Employment Security, April 1979.

[a]Utah Statistical Abstract 1979.

TABLE 3-14

Year Round Housing for Uintah County and Vernal

	Uintah County	Vernal
Owner Units		
1976[a]	3,196	1,173
1970[b]	2,565	822
Rental Units		
1976[a]	1,081	397
1970[b]	868	278
Mobile Homes		
1976[a]	1,030	323
1970[b]	297	23
Total		
1976[a]	4,986	1,830
1970[b]	3,730	1,123
Percent Increase	31	63

Source: [a]Uinta Basin Association of Governments, 1977.

[b]U.S. Department of Commerce, 1970.

TABLE 3-15

Selected School System Data for Uintah County and the State of Utah

	Percent of Faculty With Masters	Maximum Salary	Number of Schools	Pupil/-Teacher Ratio	Expenses Per Student
Uintah County	20.4	$13,500 (BS) $15,750 (MS)	9	27.2	$1,279.35
State of Utah	27.7	$13,026 (BS) $15,661 (MS)	563[a]	22.8	$1,153.04

Source: Utah Statistical Astract 1979.

[a]Bureau of Economic and Business Research, 1978.

TABLE 3-16

Physician-Dentist/Population Ration

	Total Number of Physicians	Physician/ Population Ratio	Total Number of Dentists	Dentist/ Population Ratio
Vernal	6	1:1167	7	1:1000
Uintah County	6	1:3000	7	1:2572
State of Utah (1976)[a]	1,801	1:684	851	1:1447

Source: Uintah County Hospital.

[a]Bureau of Economic and Business Research, 1979.

TABLE 3-17

Crime Statistics for Uintah County

Total County Population	18,000
Murder	0
Rape	0
Robbery	1
Assault	1
Burglary	21
Larceny Theft	92
Motor Vehicle Theft	20

Sources: Utah Bureau of Criminal Investigation, 1978.

The Vernal system serves most of Vernal City and a limited number of county residents in the immediate vicinity. The disposal system, which began operation in 1957, is overloaded from increases in population and infiltration of ground water into the collection system.

A water quality management study completed for the Uinta Basin area by the State Department of Health recommended that a valley-wide sewer system be constructed. Such a system would serve Vernal and the surrounding settlement area and solve the various problems associated with the existing collection and disposal systems.

The area has received a $6.8-million grant from the Environmental Protection Agency and State funds for a new sewage treatment lagoon system and new sewer lines. Construction began in March of 1980 and should be completed in 1981. The new plant is designed to accommodate a population of about 20,000 people with provisions for modifications to more than double this capacity.

Fire Protection

The City of Vernal is served by an all-volunteer fire department with 20 active members. Their equipment consists of two 1,250-gallon-per-minute pumpers, one 750-gallon-per-minute pumper, and one 500-pound powder unit.

Fire protection class ratings range from 1, the most adequate, to 10, the least adequate. The City of Vernal has a class rating of 6.

Law Enforcement

Law enforcement in Vernal is administered by the Uintah County Sheriff's Department, the Vernal Police Department, and the Utah State Highway Patrol. Uintah County has one full-time sheriff and nine patrolmen. The Utah Highway Patrol has 13 patrolmen assigned to cover the major highways throughout the county.

The City of Vernal has 13 full-time officers, 13 patrol cars, and one truck at its disposal.

A 6-cell detention facility is operated by the Uintah County Sheriff's Department.

Health Facilities and Personnel

Table 3-16 shows the percent ratio of doctors and dentists to population in the area in 1979.

Vernal has three medical clinics and a 31-bed hospital. Vernal has no free or nonprofit clinics. The hospital is fully equipped for surgery and other procedures and is currently being utilized well under capacity.

Ambulance service is provided by Uintah County.

Quality of Life

COMMUNITY HOMOGENEITY

Historically, communities in Uintah and Duchesne Counties have been culturally homogeneous and have valued neighborliness, friendliness, mutual self-help, close family ties, family pride, economic independence, local autonomy, and a strong religious life. Recent development has reduced this cultural homogeneity. Residents perceive these as outside influences.

PUBLIC ATTITUDES

Project area residents have traditionally regarded the natural environment as important to personal psychological well-being. While local people enjoy the rural landscape character, great emphasis is also placed on controlled economic development. In response to a survey (Opinion Sampling Research Institute 1975) concerning the alternatives of economic growth versus rural character, 63 percent of Vernal residents indicated economic growth was important, 26 percent felt that rural character was important, and 11 percent were undecided. Similar responses indicated that increases in population would be favored if local taxes would rise only moderately.

An attitudinal survey in the Vernal area (Geertsen et al. 1975) indicated that 79 percent of residents felt their community was a good or excellent place to live, and 64 percent felt they were fully accepted as a part of the community. Forty-nine percent of the respondents said Vernal was a good place to raise a family, and 38 percent thought it was satisfactory. Nearly 43 percent said the community provided satisfactory opportunities to earn an adequate income. Thirty-three percent said Vernal had excellent economic opportunity.

QUALITY OF LIFE INDICATORS

Conservative social attitudes and emphasis on strong family ties have helped maintain low to average divorce rates in the area. Divorce rates were 3.6 per 1,000 population for Uintah County in 1975, 6.2 per 1,000 for 1976, and 4.7 per 1,000 for 1977 (Utah Bureau of Health Statistics).

For its populations, juvenile deliquency appears to be a substantial problem in the impact area. Uintah County reported 455 offenses in 1978 (Utah Bureau of Criminal Identification 1978). In contrast, low incidence of high school dropouts is indicative of the traditional emphasis given to formal education.

In the last 3 years, Uintah High School (Vernal) had 38 dropouts out of an enrollment of 866 (Uintah High School 1979).

There are low incidences of crime, as would be expected in a rural area. Table 3-17 lists the basic crime statistics that have been recorded for the project area.

LINEAR FEATURE PROFILES

Existing environmental features along proposed linear features are noted in Figures 3-11 to 3-16. These include the transmission lines (2) and access roads (2) associated with the White River Dam and the Green River Pipeline. A key to abbreviations used precedes the figures.

(FIGURES 11-16)

LINEAR FEATURES PROFILES - KEY

Vegetation

C Cultivated
CD Cold Desert Shrub
F Forest
MB Mountain Bench
PJ Pinyon-Juniper
R Riparian Crossing
W Wetlands

Endangered or Threatened (E&T) Plants/Habitat

H E&T Habitat
HP E&T Potential Habitat

Visual Features

Scenic Quality

A High
B Medium
C Low

Sensitivity

H High
M Medium
L Low

Visual Zones

F Foreground
M Middleground
B Background
SS Seldom Seen

Land Use As Stated

Land Ownership

BLM or Bureau of Land Management

FS Forest Service
I Indian
P Private
S State
M Multiple Ownership

Special Animals

1. Critical E&T Habitat
2. Critical Habitat for Rare Colorado Cutthroat Trout

BE Bald Eagle
GE Golden Eagle
H Wild Horse
R Raptor Area
WC Whooping Crane

Game Animals

3. Critical Trout Habitat
4. High Priority Trout Habitat
5. Substantial Trout Habitat
6. Limited Trout Habitat
7. Limited Channel Catfish Habitat

A Antelope
D Deer
E Elk
F Waterfowl
M Moose
SG Sage Grouse
ST Sharptail Grouse

Paleontological Resources

H Potentially High Significance
M Potentially Medium Significance
L Low Significance
N Negligible Significance

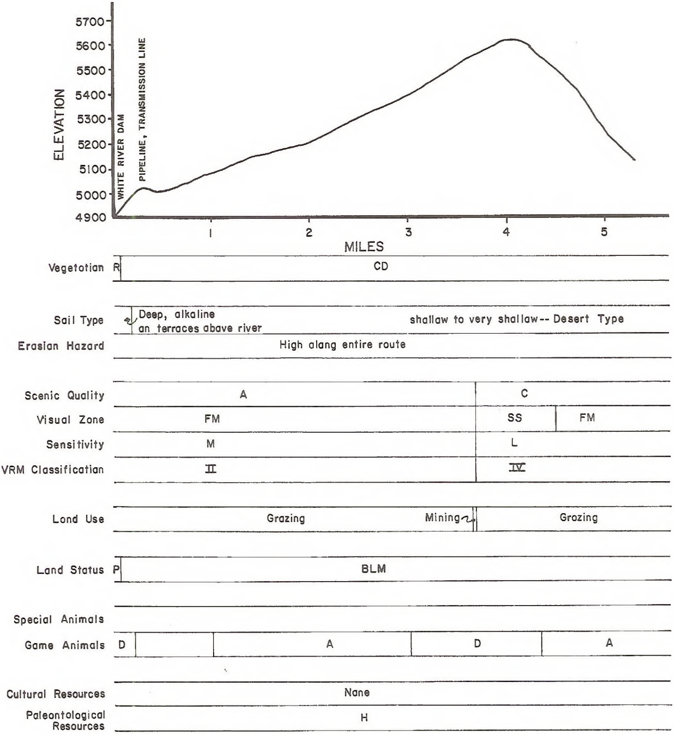
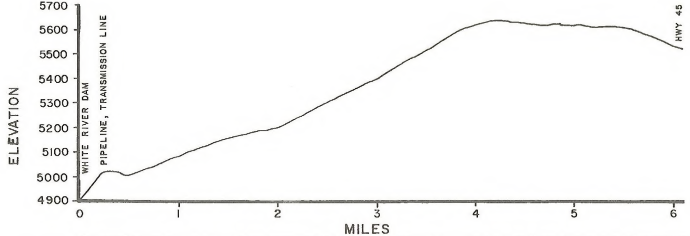


Figure 3-11
LINEAR PROFILE FOR ALTERNATIVE A, ACCESS ROAD FROM BONANZA



Vegetation	R / CD
Soil Type	Deep, alkaline on terraces above river / Shallow to very shallow -- Desert Type
Erosion Hazard	High
Scenic Quality	A / C
Visual Zone	FM / SS / FM
Sensitivity	M / L
VRM Classification	II / IV
Land Use	Grazing / Mining / Grazing
Land Status	P / BLM
Special Animals	None
Game Animals	D / / A / D /
Cultural Resources	None
Paleontological Resources	H

Figure 3-12
LINEAR PROFILE FOR ALTERNATIVE B, ACCESS ROAD FROM HIGHWAY 45

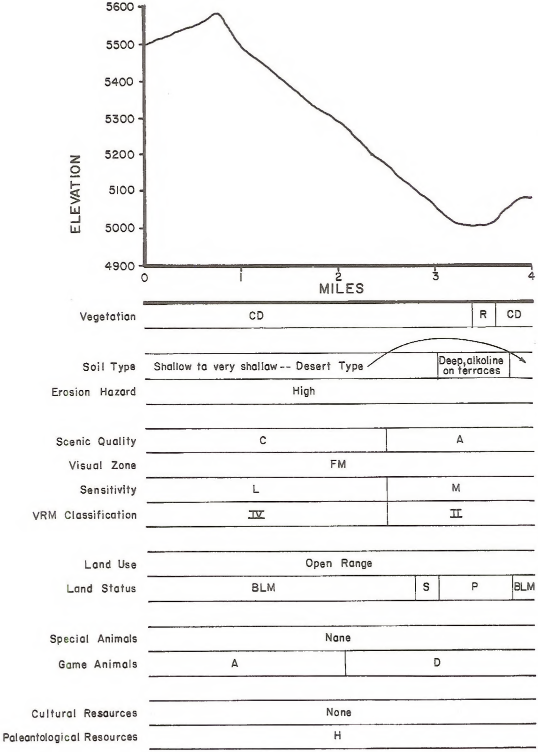


Figure 3-13
LINEAR PROFILE FOR ALTERNATIVE D, WAGONHOUND ACCESS ROAD

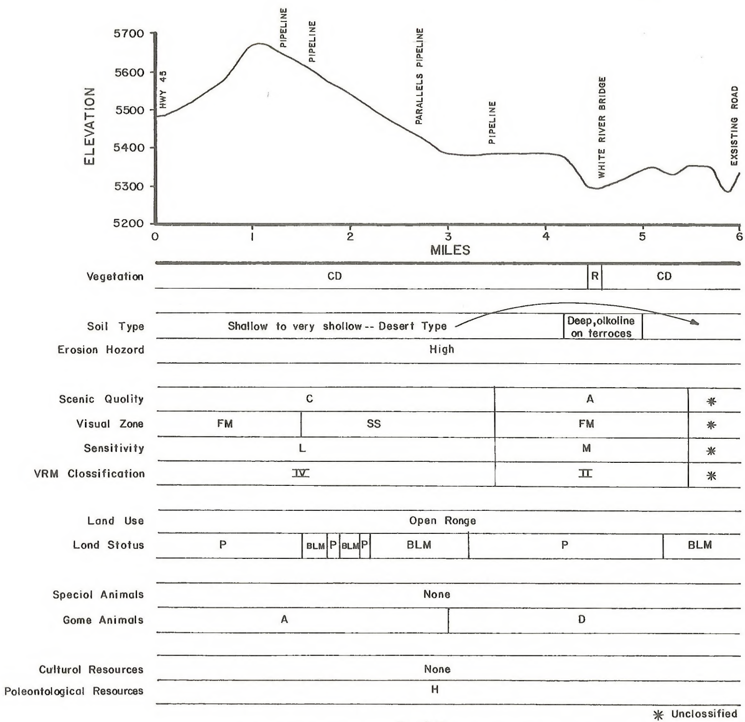


Figure 3-14
LINEAR PROFILE FOR ALTERNATIVE E, ACCESS ROAD FROM BONANZA

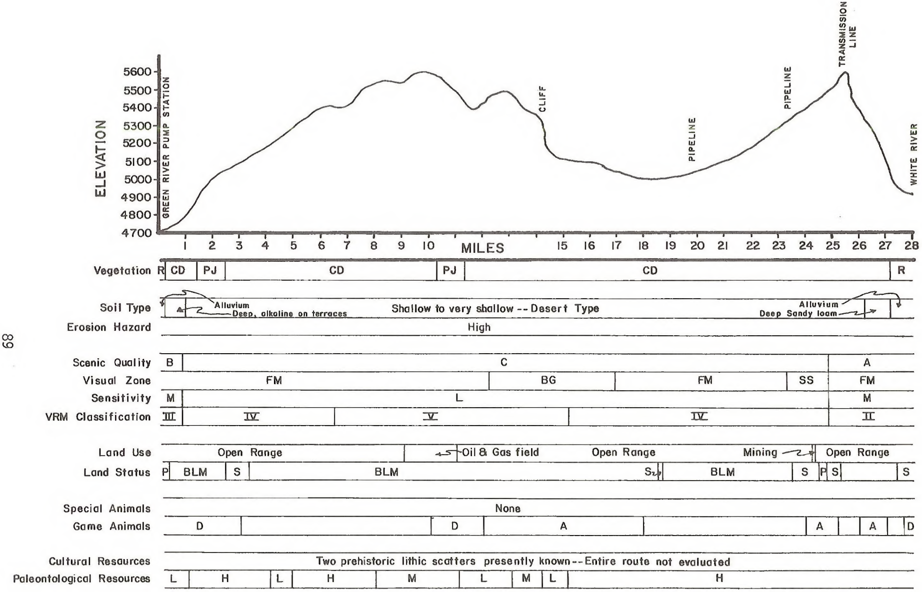
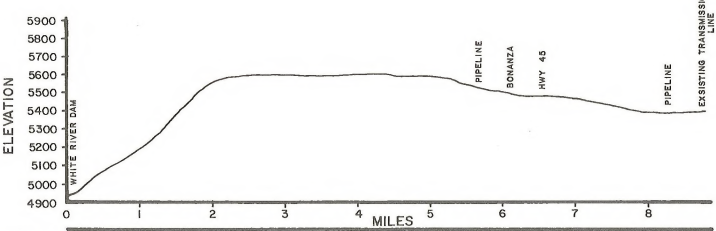


Figure 3-15
LINEAR PROFILE FOR GREEN RIVER PIPELINE AND TRANSMISSION LINE TO MOON LAKE POWER PLANT, BONANZA SITE



Vegetation	R	CD		
Soil Type	Deep, alkaline on terraces above river	Shallow to very shallow--Desert Type		
Erosion Hazard	High			
Scenic Quality	A	C		
Visual zone	FM	SS	FM	
Sensitivity	M	L		
VRM Classification	II	IV		
Land Use	Grazing	Mining	Grazing	
Land Status	P	BLM	P	BLM
Special Animals	None			
Game Animals	D	A		
Cultural Resources	None			
Paleontological Resources	High			

Figure 3-16
LINEAR PROFILE FOR TRANSMISSION LINE FROM WHITE RIVER DAM TO EXISTING TRANSMISSION LINE

CHAPTER 4

ENVIRONMENTAL CONSEQUENCES

INTRODUCTION

This chapter evaluates the environmental impacts that would be expected from construction and operation of the White River Dam or its alternatives. The impacts discussed are those that would significantly affect the quality of the human environment. An impact is considered significant if it:

1. Is controversial;
2. Is of high public interest or concern;
3. Substantially affects the human environment; or
4. Concerns a subject protected by law.

Magnitude, incidence, and duration of impacts are indicated where possible. National, regional, or local importance of impacts are also indicated in some instances.

The discussion is presented by alternatives. Each alternative is discussed by resource category in a systematic 3-step analysis process:

1. Using information on the existing environment presented in Chapter 3, the anticipated impacts are identified; then
2. Known mitigation measures are discussed as they may reduce the impacts; then
3. Residual unavoidable adverse impacts are identified.

In this process, the effectiveness of the mitigating measures is addressed as applicable. Unavoidable adverse impacts are negative impacts that remain despite mitigation efforts. Additional sections include a summary of the significant unavoidable adverse impacts, irreversible/irretrievable commitments of resources, and the relationship of short-term use of the environment to maintenance and enhancement of long-term productivity, as well as a section on cumulative impacts.

Climate, air quality, topography, and geology are not discussed in this chapter, since none of the project alternatives affect these features to any extent. Table 4-1 lists the various alternatives and indicates the acres of land disturbed and occupied by project feature. Figure 4-1 shows land ownership in the project area for all alternatives. Indian lands in the project area are too small to show up in this figure.

ALTERNATIVE 1: WHITE RIVER DAM AND RESERVOIR

Minerals

ANTICIPATED IMPACTS

The White River Dam and Reservoir would inundate 11 existing oil and gas leases as well as 3 pre-1920 unpatented mining claims and a portion of potentially recoverable oil shale deposits. The reservoir would hinder the exploration and use of the oil and gas leases and would prohibit the development of the mining claims. The loss of resources resulting from this action is unquantifiable. About 165 acres of Oil Shale Tracts Ua and Ub would be inundated. The reservoir would not limit the mining of oil shale on all other parts of Tracts Ua and Ub (Phillips 1980).

Access road Alternative A would cross 8 oil and gas leases, Alternative B crosses 7, neither cross unpatented mining claims. Access road Alternatives D and E would cross oil and gas leases in areas where these roads would require little new construction; therefore, impacts would not occur. Alternative E crosses 2 unpatented oil shale mining claims.

The transmission line to the proposed Moon Lake Power Plant would cross 8 oil and gas leases, the route to the existing Moon Lake transmission line would cross 14 leases. Neither route would cross unpatented mining claims. Impacts to the leases or claims by these linear features would not adversely impact the ability to explore or recover the potential resources, except for a short period during construction.

A portion of the oil shale withdrawal of public lands may have to be revoked to allow construction and filling of the proposed reservoir, inasmuch as it would be a substantial land use commitment of long duration.

MITIGATION

Any adverse economic impacts associated with oil and gas leases and mining claims would be mitigated by a fair compensation to the leasors or locators or by other arrangements made by the Utah Division of Water Resources prior to construction. It

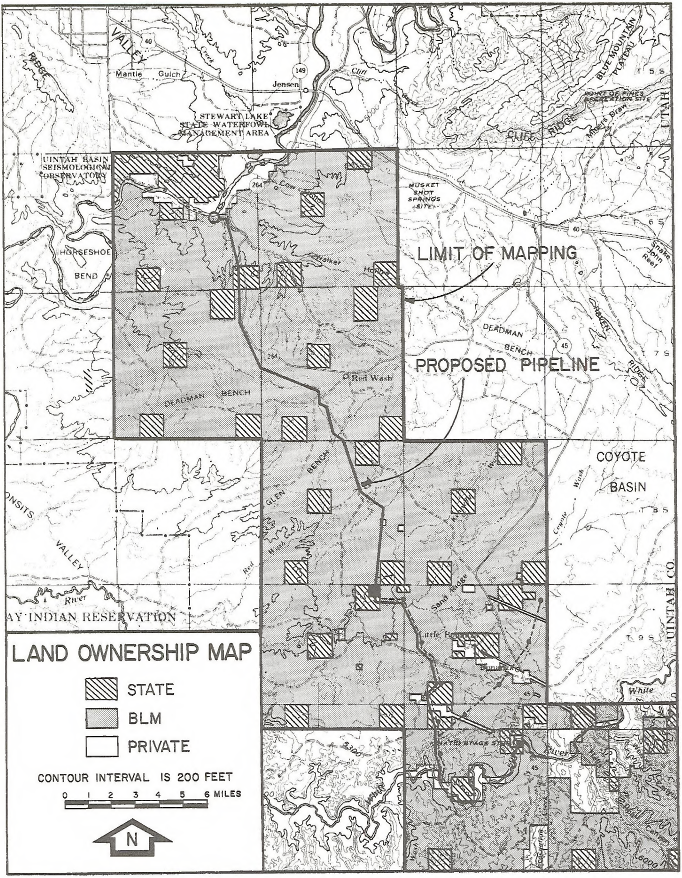


Figure 4-1
LAND OWNERSHIP OF THE WHITE RIVER DAM PROJECT AREA

TABLE 4-1

Number of Acres Disturbed and Occupied for Each Alternative by Land Ownership

	Disturbed					Occupied				
	Total	BLM	State	Private	Ind.	Total	BLM	State	Private	Ind.
ALTERNATIVE 1 - White River Dam										
Dam and Spillway	122	34	--	88	--	122	34	--	88	--
Reservoir	1,860	580	301	872	104	1,860	580	301	872	104
Transmission Lines										
To Moon Lake PP	69	41	13	15	--	23	15	4	4	--
To Substation	74	54	4	16	--	22	16	1	5	--
Access Roads										
Alternative A	50	49	0	1	--	11	10	0	1	--
Alternative B	49	47	0	2	--	13	13	0	<1	--
Alternative C	7	7	0	0	--	2	2	0	0	--
Alternative D	31	22	3	4	--	9	6	1	2	--
Alternative E	59	20	0	39	--	16	6	0	10	--
Borrow Areas	1,539	1,204	335	0	--	0	0	0	0	--
Recreation Sites										
Ignatio Bridge	3	0	0	3	--	2	0	0	2	--
Below Dam	2	0	0	2	--	1	0	0	1	--
North of Dam	2	2	0	0	--	2	2	0	0	--
Total	3,647	1,910	652	981	104	2,021	641	305	968	104
ALTERNATIVE 3 - Hell's Hole Dam and Reservoir										
Dam and Reservoir	275	69	0	206	--	275	69	0	206	0
Pumping Station and Pipeline	3.5	3.5	0	0	--	2	2	0	0	--
Power Distribution Line	22	11	5.5	5.5	--	7	3.5	1.6	1.6	--
Access Roads	39	5	0	34	--	20	2.6	0	17.4	--
Total	339.5	88.5	5.5	245.5	--	304	77.1	1.6	225	--
ALTERNATIVE 4 - Pumping From Green River										
Pipeline	380	316	37	27	--	34	29	3	2	--
Pump Stations	45	45	0	0	--	45	45	0	0	--
Powerlines	Included in above figures.					15	13	2	0	--
Total	425	361	37	27	--	94	87	5	2	--
ALTERNATIVE 5 - Pumping From White River and Supplementing With Water Pumped From Green River										
Pipeline	380	316	37	27	--	34	29	3	2	--
Pumps	105	75	30	--	--	105	75	30	0	--
Powerlines	Included in above figures.					15	13	2	0	--
Total	485	391	67	27	--	154	117	35	2	--

is not fully known what exploratory work has been done to estimate locations, quantities, and kinds of minerals that could be affected. BLM would make any land use grant for a new project subject to existing valid leases and claims.

UNAVOIDABLE ADVERSE IMPACTS

Some unquantifiable amount of oil shale and other minerals would not be available for extraction during the life of the project in the 1,890 acres (765 ha) inundated by the reservoir.

Paleontology

ANTICIPATED IMPACTS

Direct impacts on important fossils would result from construction activities and inundation by the reservoir in 2,012 acres (814 ha). Roadway improvements, new road construction, borrow removal, and power line construction could also directly impact important fossil material in another 1,866 acres (755 ha).

Construction activities associated with the proposed dam could disturb the position and relationships of fossils and result in the loss of scientific and educational values. The greatest impact would be in those formations with potential for high paleontological significance (Green River and Uinta Formations). However, with the measures required of the applicant by Federal agencies for protection of paleontological resources, construction activities could provide new paleontological information. New access into the area would allow rockhounding in remote areas and result in an unquantifiable loss of paleontological resources which have scientific and educational values.

Increased collecting and removal of known fossils in the region would likely result from increased numbers of people associated with the proposed project. Such activity is impossible to quantify but scientifically important fossils could be removed from location without proper documentation of information. Scientific and educational values would be lost, the significance of which is unknown.

MITIGATION

The applicant would obtain the services of a qualified paleontologist who would be approved by the appropriate Federal official. The paleontologist would conduct an intensive survey of all areas to be disturbed which have high potential for paleontological resources. The paleontologist would be available, as needed, during surface disturbance. If the paleontologist determined that paleontological values would be lost, construction would be halted until appropriate records or salvage action could be taken.

UNAVOIDABLE ADVERSE IMPACTS

Even with the suggested mitigation, some unavoidable loss of fossils potentially important to science could occur in 3,600 acres (1,457 ha). It is unlikely any such loss would be of great significance to the human environment as a whole.

Soils

ANTICIPATED IMPACTS

The construction and vegetation clearing associated with the dam in Alternative 1 would increase soil loss through erosion on about 122 acres (49 ha). Vegetation clearing in the reservoir basin would also increase soil loss through erosion. Both of these impacts would be short term, occurring only during and immediately after construction.

The construction of access roads, power lines, material sites, and recreation sites would disturb vegetation on the acreages indicated in Table 4-1. This would lead to increased erosional losses on about 1,665 acres (674 ha), especially on steep slopes which occupy about 40 percent of the project area.

Therefore, increased erosion could be experienced on at least 1,787 acres (723 ha).

MITIGATION

A revegetation program would be required by BLM to stabilize the soils disturbed by construction activities. A temporary program, involving seeding with selected plant species (yellow sweet clover, barley, and others), would be used for disturbed areas which would ultimately be inundated by reservoir areas. A permanent program, involving seeding and transplanting native plant species adapted to the project area, would be used for disturbed areas above the reservoir high water elevation or outside the dam and reservoir areas (Institute for Land Rehabilitation 1979a, 1979b). Revegetation would not be fully effective in the short term due to the time required for recovery and growth. In addition, erosion on slopes would be minimized by construction

of waterbars on grades over 4 percent where vegetation was disturbed or removed.

UNAVOIDABLE ADVERSE IMPACTS

Unavoidable impacts resulting from disturbances by the various alternatives could include: an unquantifiable loss of topsoil and subsoil, increased overland water flow, increased sediment production, formation of rills and gullies, and unearthing and silting-in of plants. A loss of topsoil and subsoil would expose geologic parent material and hinder natural and artificial revegetation. Bare soils and developing water channels would increase overland water flow, and hence increase the erosive force and sediment load of the moving water. Some unquantifiable amount of soil could be lost through erosion on at least 1,787 acres (723 ha). The duration of loss would extend through a few years or several decades, depending on the severity of the disturbances. Total removal of existing soils would cause impacts for several decades as soil rebuilds very slowly in this area.

Water Resources

DOWNSTREAM FROM THE PROPOSED DAM

ANTICIPATED IMPACTS

Construction of the proposed White River Dam and Reservoir would impact the water resources of the White River downstream of the dam and the Green River below the confluence by diverting certain quantities of water from the system for consumptive uses (Tables 4-2 and 4-3). Expected depletions from the rivers in terms of "normal" and "worst case" conditions are provided in Tables 4-2 and 4-3, respectively. The values utilized for this portion of the tables were based upon computer simulations prepared by the Utah Division of Water Resources (1980a). The amounts of water involved in this analysis include: White River Shale Project, 26,000 acre-feet; TOSCO, 18,000 acre-feet; Moon Lake Power Plant, 18,000 acre-feet; and reservoir evaporation, 5,500 acre-feet. This is a total annual requirement of 67,500 acre-feet or 97 cfs on a continuous basis, as indicated in Chapter 2. These simulations include no developments other than the White River Dam, and would change upon the inclusion of any other water development in Colorado on the White River and/or downstream water resource development.

The reduction in flows during normal years (Table 4-2) would generally range from 80 to 100 cfs, except during May, when it would climb to 395 cfs due to actual depletion and storage of high flows. Natural flows would be augmented in March and April by the reservoir operation. Water would be stored in the reservoir primarily during spring runoff. A minimum release would be maintained to meet downstream Ute Indian water rights and power generation needs, except during low flow periods. During low flow periods, represented by the worst case of record (1976-1977), releases would be the actual flow of the river during periods when flow was lower than 250 cfs. Flows would be depleted during all months somewhat more evenly in these situations (Table 4-3). Flows in the White River would be depleted about 20 percent during most months in normal flow years, but this would increase to 20 to 30 percent during most months in low flow years.

These depletions would not have any effects on existing water rights, since the only present downstream users on the White River are the Ute Indians and their right (see Appendix 3) would be allowed to pass the reservoir. The water depletion from the White River Dam for energy development would be a portion of the water allocated to the State of Utah under the Colorado River Compact.

Loss of flows in the Green River would be less significant than those from the White due to the moderating effect of the larger river. In normal flow years, depletions during most months in the Green River would be about 2 percent (Table 4-2), while in low flow years the depletions during all months would be from 1 to 3 percent (Table 4-3). These depletions also would not affect downstream or upstream existing water rights.

Construction and operation of the dam would modify downstream channel morphology in the White River over a period of years. Because the dam would trap an estimated 94 percent of the sediment, releases would be nearly sediment-free during the initial 20 years of the dam, and hence result in substantial scouring for a number of miles downstream (Clyde 1980).

The gradual loss of fine sediments and accumulation of larger particles on the streambed (a process known as "armor plating") would eventually cause a decrease in sediment transport. However, the stream bottom morphology would have been modified considerably during the approximately 20 years before this equilibrium was attained. This impact would occur over the entire downstream extent of the river, but would lessen with increased distance below the dam (Clyde 1980). Land islands developed by the meandering stream would not be scoured by high water as experienced in the past.

TABLE 4-2

Normal Water Depletions Under Various Alternatives[a]

Month	White River: Normal Mean Flow at Watson Gage (cfs)	White River: Depletions (cfs) Alt. 1	Alt. 3	Alt. 4	Alt. 5	Green River: Normal Mean Flow at Green River Utah (cfs)	Green River: Depletions (cfs) Alt. 1	Alt. 3	Alt. 4	Alt. 5
Oct.	421	101	97	0	97	3,238	102	97	97	97
Nov.	399	91	"	"	"	3,412	91	"	"	"
Dec.	350	85	"	"	"	3,350	85	"	"	"
Jan.	354	83	"	"	"	3,434	83	"	"	"
Feb.	376	35	"	"	"	3,680	35	"	"	"
Mar.	520	[6][b]	"	"	"	4,343	[6]	"	"	"
Apr.	551	[9]	"	"	"	5,598	[9]	"	"	"
May	1,422	395	"	"	"	11,931	395	"	"	"
June	1,765	91	"	"	"	14,446	91	"	"	"
July	637	81	"	"	"	6,177	81	"	"	"
Aug.	395	97	"	"	"	3,537	97	"	"	"
Sept.	381	87	"	"	"	3,001	87	"	"	"

[a]Based on period of record 1963-1978 to coincide with closure of Flaming Gorge Dam.

[b]Brackets, [], indicate flow augmented by amount shown.

TABLE 4-3

Worst Case Water Depletions by Alternative
During Driest Period of Record

Month	White River: Observed Discharge at Watson Gage (cfs)	White River Deplentions (cfs): Alt. 1	Alt. 3	Alt. 4	Alt. 5	Green River: Observed Discharge at Green River Utah (cfs)	Green River Depletions (cfs): Alt. 1	Alt. 3	Alt. 4	Alt. 5
1976										
June	1,203	106	97	0	97	11,051	106	97	97	97
July	364	108	97	0	97	4,575	108	"	"	"
Aug.	337	106	87	0	87	3,357	106	"	"	"
Sep.	287	51	37	0	37	3,109	51	"	"	"
Oct.	384	135	97	0	97	3,485	135	"	"	"
Nov.	345	89	95	0	95	3,684	89	"	"	"
Dec.	293	85	43	0	43	3,671	85	"	"	"
1977										
Jan.	320	84	70	0	70	3,850	84	"	"	"
Feb.	349	80	97	0	97	3,592	80	"	"	"
Mar.	395	70	97	0	97	4,666	70	"	"	"
Apr.	412	93	97	0	97	4,474	93	"	"	"
May	384	99	97	0	97	5,650	99	"	"	"
June	264	53	14	0	14	4,410	53	"	"	"
July	140	0	0	0	0	2,978	0	"	"	"
Aug.	207	0	0	0	0	2,760	0	"	"	"
Sept.	212	0	0	0	0	2,358	0	"	"	"
Oct.	270	67	20	0	20	1,898	67	"	"	"
Nov.	311	100	61	0	61	1,951	100	"	"	"
Dec.	277	74	27	0	27	1,926	74	"	"	"
1978										
Jan.	299	96	49	0	49	2,049	97	"	"	"
Feb.	306	78	56	0	56	2,247	78	"	"	"
Mar.	457	174	97	0	97	4,035	174	"	"	"
Apr.	603	6	97	0	97	6,287	6	"	"	"
May	1,514	574	97	0	97	11,158	574	"	"	"

Projections of downstream water quality characteristics as a result of the dam are subject to considerable variability. Retention time in the reservoir is estimated to be 11 to 14 days during runoff, 19 to 24 days as runoff recedes, and 44 to 76 days during low flow periods. Much of the flow in the system would move through the reservoir rather rapidly after it filled. During the annual turnover (thermal circulation of the entire body of water), there would be substantial increases in phosphorus content as oxygen-deficient water from the inactive storage area circulated and was released downstream (Lamarra 1980). In addition, releases of hydrogen sulfide would also occur at this time from similar sources (Lamarra 1980).

An analysis of projected water temperatures of the White River downstream of the dam was prepared by Grenney and Caupp (1980). Utilizing a water temperature simulation model (Grenney et al. 1980), water temperatures were predicted at several flow rates for various distances downstream of the dam, assuming a release temperature of 56F (13.3C). The conclusions of the analysis are:

1. The dam (based on current design) would result in generally lower maximum water temperatures than historical values for flows greater than 50 cfs.

2. Depending on flow, 80 to 90 percent of the temperature increase over projected release temperatures would occur within 15 miles (24 km) downstream of the dam (Grenney and Caupp 1980) and would not cause any change to present irrigators.

Sediment levels would be reduced considerably over present conditions due to the trap efficiency of the reservoir. Based on the methods of Hawkins (1980), outflow concentrations of suspended solids below the dam would be approximately 175 parts per million. As a result, the tailwater would be essentially clear most of the year. This would make water withdrawal in the lower White River for irrigation easier and less expensive, primarily because equipment (pumps) would last longer and breakdowns would be reduced. The clearer flows could stimulate additional agricultural development in the lower White River, which would ultimately increase the water depleted from the river.

Depletions at the level indicated in Table 4-2 from the river would cause an estimated increase of 3.4 mg/l in Colorado River salinity at Imperial Dam, California. Annual costs of salinity increases are estimated to be $430,000 per mg/l increase at Imperial Dam (Clinton 1980).

MITIGATION

The Utah Division of Water Resources has indicated that, if necessary, the outlet works would be redesigned to increase water temperatures above those anticipated with the original design in order to be able to match existing river temperatures.

UNAVOIDABLE ADVERSE IMPACTS

The White and Green Rivers would be depleted by 67,500 acre-feet per year. The channel of the White River below the dam would be armored as fine sediments would be scoured out of the bed. Water clarity would increase. Salinity would increase at Imperial Dam, California, by 3.4 mg/l.

RESERVOIR AREA

ANTICIPATED IMPACTS

It is anticipated the reservoir would be eutrophic (highly productive biologically and oxygen consumptive) in nature (Lamarra 1980). Turbidity levels could limit light availability, hence algal production. In addition, preliminary analyses indicate that nutrient levels would be nitrogen limited. The reservoir is, therefore, expected to be one in which high demands for oxygen would exist, but where primary production could be limited by light and nutrients.

A deep body of water in an area of extreme seasonal climatic variations such as the reservoir would thermally stratify into distinct layers during the summer months. This stratification is important in that it controls the water temperature at various water depths in the reservoir, the timing and rate of mixing of the entire body of water, and the oxygen concentration within the reservoir. Figure 4-2, taken from Lamarra (1980), depicts thermal stratification of the proposed reservoir as determined by Utah Division of Water Resources (1980b) and that of Deer Creek Reservoir in central Utah.

Thermal stratification processes are expected to result in severe oxygen depletions in the lower portions of the reservoir for periods of at least 100 days each year, frequently becoming anoxic (totally depleted of oxygen) (Lamarra 1980). This characteristic would have a detrimental impact upon any potential cold-water reservoir fishery, since fish would not be able to survive in the cold-water zone.

An additional concern relative to the reservoir is the potential for contamination of the water due to contact with oil shale outcroppings. Oil shale leachate is a complex waste including salts, heavy metals, and organic compounds. Cleave et al.

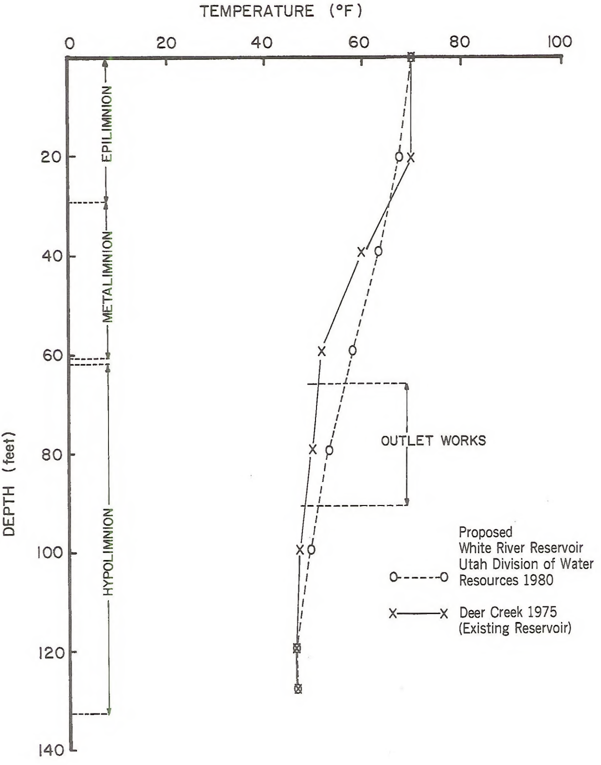


Figure 4-2
PREDICTED THERMAL STRATIFICATION OF THE PROPOSED RESERVOIR, AND THE MID JUNE, 1975, PROFILE OF DEER CREEK RESERVOIR IN UTAH

(1979) found that the ion composition and pH of oil shale leachate is dependent upon the contact time of the water with the oil shale. Leaching tests by Colorado State University (1971) indicated a definite potential for high salt concentrations in runoff from spent oil shale residues. In addition, certain organic substances present in processed oil shale are suspected of being carcinogenic hazards. Studies by Maase and Adams (1980) regarding the presence of certain of these compounds and their movement from processed oil shale indicated that a potential does exist for their entry into the runoff process.

However, as indicated above, the majority of available research has been conducted on spent or processed oil shale residues. In summary, it is assumed that in situ deposits would not be subject to the same levels of extensive leaching, and the potential for adverse chemical impacts would therefore be substantially decreased.

Because preliminary investigations of the sedimentation characteristics of the proposed reservoir indicated a potential for higher levels of sediment accumulation and turbidity than suggested in the original Utah Division of Water Resources (1980c) action plan, more detailed analyses of the process were developed. After reviewing previous estimates of sediment yield on the White River relative to this project and discussions by an interagency group convened to consider approaches to the problem, Grenney and Kraszewski (1980) developed an estimate utilizing the flow-duration, sediment rating curve technique (USBR 1951). In a separate report, Hawkins (1980) addressed sediment trapping, bulk density, and turbidity in the reservoir.

Although limited by the lack of readily available data, primarily recent and complete flow-duration curves for the three major flow regimes of the White River near Watson, Grenney and Kraszewski (1980) arrived at an estimated total sediment load of 2.2 million tons per year. This figure was derived by applying the techniques and assumptions agreed upon by the interagency group during its discussions and is considered state-of-the-art with regard to approach and data availability.

The analysis prepared by Hawkins (1980) takes a convenient value for sediment yield (3 million tons/year) and proceeds through a series of calculations to evaluate various levels of trap efficiency and sediment bulk density. Information is provided to evaluate these factors under any given level of sediment yield. The interagency group decided to assume a trap efficiency of 94 percent and a density of 75 lb/ft³ for the reservoir.

Utilizing the method of Hawkins (1980) and the above assumptions, 1,273 acre-feet of sediment would lodge in the reservoir each year. Most of this sediment (1,151 acre-feet/year) is suspended, which includes the finer particles. A smaller portion (122 acre-feet/year) is bedload, primarily sand and larger rock particles. Using these figures, the probable life of the proposed reservoir's dead storage (38,000 acre-feet) would be 33 years and the entire reservoir (105,000 acre-feet) would fill with sediment in 82 years.

Of course, any additional upstream depletion on the main stem White River would substantially reduce sediment load in the White River Reservoir and lengthen its life accordingly. The uncertainty of construction of main stem dams in Colorado, including their location and size, prohibits quantification of these changes in the life of the White River Reservoir at this time.

In an evaluation of the reservoir's capability to provide the necessary quantities of water (70,000 acre feet/year or 97 cfs) over the long term, reservoir storage requirements to satisfy needs during the "worst case" situation of June 1976 to February 1978 were analyzed. The following assumptions were used in the analysis:

1. No storage water was required when natural flows exceeded 347 cfs.

2. Storage water was needed when flows were below 347 cfs.

3. The entire 97 cfs was needed from storage when flows were lower than 250 cfs (left in river for downstream uses).

4. When flows were lower than 250 cfs, the natural flow of the river was all that was available to downstream users.

Using the above assumptions and the 1976-1978 flow data, the proposed White River Dam would have had to supply 39,000 acre-feet of storage in 1976-1978 to meet the total need of 70,000 acre-feet. Using the sedimentation characteristics of the reservoir discussed above (1,273 acre-feet of sediment per year), after 52 years the White River Dam would be sufficiently filled with sediment such that it supplied only 39,000 acre-feet of storage. After 52 years, the reservoir could not supply sufficient storage for the "worst case" situation. Once again, upstream dams on the main White River in Colorado would increase the useful life of the White River Dam Project.

MITIGATION

Potential water quality problems associated with the inundation of oil shale could be identified by establishing a monitoring program to sample monthly and evaluate water quality at several points in the reservoir four times per year. If health problems de-

velop, appropriate remedial action may be determined by the Utah Division of Health and the Environmental Protection Agency.

UNAVOIDABLE ADVERSE IMPACTS

Sedimentation of the reservoir would be unavoidable and would impact the long-range future utility of reservoir storage.

GROUNDWATER

ANTICIPATED IMPACTS

Based on Philips (1980), it is assumed that the construction of the dam would not impact the groundwater of the area.

The potential does exist for increased groundwater recharge as a result of the overlying reservoir. In those areas where increased recharge occurs, groundwater quality could improve slightly in response to dilution with higher quality surface water.

MITIGATION

None.

UNAVOIDABLE ADVERSE IMPACTS

None.

WETLANDS AND FLOODPLAINS

ANTICIPATED IMPACTS

The construction of the dam and filling of the reservoir would inundate approximately 995 acres (403 ha) of riparian floodplain outside the river channel. An additional 4,575 acres (1,852 ha) of riparian floodplain would be altered between the dam and the confluence with the Green River by the decrease in high flows and the stream channel armoring. These processes would cause less area to be flooded each year, therefore decreasing the size of the active floodplain. Islands which presently are flooded during some spring runoffs would no longer be inundated. This riparian area is of substantial ecological value and is protected under Presidential Executive Orders 11988 (1978) and 11990 (1978) concerning floodplain management and protection of wetlands, respectively.

The 115 acres of wetlands near the mouth of the White River would not be affected by this project, as they are primarily sustained by irrigation return flows.

MITIGATION

None.

UNAVOIDABLE ADVERSE IMPACTS

Approximately 995 acres (403 ha) of riparian floodplain would be lost by construction of the dam and reservoir; which represents approximately 16 percent of the total White River riparian floodplain in Utah. Another 4,575 acres (1,852 ha) below the dam would be affected by decreased flows and armoring, causing a decrease in total riparian acreage.

Vegetation

ANTICIPATED IMPACTS

Plant productivity, cover, and density data for the different vegetation types (Allan 1979, VTN Colorado, Inc. 1977) provide a basis for predicting the effects of the proposed developments on the vegetation in the project area. Riparian areas which presently or could potentially support broadleaf vegetation (i.e., cottonwoods and others) in semi-arid ecosystems are of special management concern. As noted in Executive Orders 11988 and 11990 (1978), it is Federal policy to avoid construction in riparian areas and to minimize loss of riparian vegetation in semi-arid environments.

The acreages of vegetation types which could be disturbed or eliminated by the proposed project are listed in Chapter 3 (Table 3-5).

The removal of vegetation in the fluctuation zone prior to filling the reservoir would create a 46-foot-high (14 m) denuded area around the perimeter of the reservoir just below the proposed shoreline elevation. The primary concern associated with construction activities would be the possibility of erosion on steeper slopes which could affect plant communities by silting-in or unearthing plants near developing water channels.

An estimated 995 acres (403 ha) of riparian and 547 acres (221 ha) of upland (sagebrush-greasewood and shadscale) vegetation would be inundated by the reservoir at the normal water surface elevation. The potential loss of plant productivity and cover resulting from disturbance and inun-

dation is expected to be of local importance to wildlife and livestock, especially in the riparian vegetation type.

In general, an average fluctuation of 9 vertical feet (3 m) in reservoir depth under normal conditions would not have much impact on the vegetation immediately surrounding the reservoir. A drop of 9 feet in reservoir depth would expose approximately 47 acres (19 ha) of previously inundated riparian land at the upper end of the reservoir and, over an extended period of time, riparian vegetation would encroach on the exposed area. This newly formed riparian vegetation would again be inundated as the reservoir level rose to its normal maximum height.

No riparian vegetation establishment would be expected along the shorelines in the sagebrush-greasewood and shadscale types due to the relatively steep slopes and the low water holding capacity of the shallow soils. However, plant species common to these two upland vegetation types could become established in scattered locations such as side canyon draws.

Fluctuations in discharge rates from the dam, above or below the seasonal average flows, could have an effect on riparian vegetation along the White River from the dam site downstream to the confluence with the Green River. Cottonwood trees, for instance, require flooding for the seedlings to germinate. Reduction in flows below the dam during spring runoff would decrease the magnitude and frequency of the flooding, thereby reducing the potential for cottonwood germination. This decrease would create an unquantifiable reduction in cottonwoods along the White River. Maintenance of the anticipated minimum release of water over 5-10 years could lead to an encroachment of riparian vegetation toward the center of the river channel. In addition, a decrease of high flow levels would reduce the number of sand bars presently inundated annually. Therefore, an unquantifiable change of downstream riparian vegetation would occur, potentially affecting up to 4,575 acres (1,852 ha) of present riparian vegetation.

Approximately 1,539 acres (623 ha) of sagebrush-greasewood and shadscale vegetation would be destroyed by the removal of dam embankment materials from potential off-site borrow areas. Even though relatively large acreages of vegetation would be affected, the impact is expected to be of low significance due to the condition and abundance of these vegetation types in the White River project area. Borrow material for the approach grades at the proposed Ignatio Bridge would be derived primarily from the straightening of the existing road through Wagon Hound Canyon, and the impact on vegetation is expected to be minimal.

Improvement and realignment of access roads from Wagon Hound Canyon to the White River Dam (Alternatives A and B) (Figure 2-11) and Ignatio Bridge (Alternative D) would eliminate small acreages (see Table 3-5) of vegetation, primarily upland types. This impact on vegetation would be of low significance. The alternative access road from Bonanza across the reservoir (Alternative E) (between Hell's Hole Canyon and Evacuation Creek) to Highway 45 would have a greater impact on vegetation than the access road through Wagon Hound Canyon to Ignatio Bridge (Alternative D) due to its greater length (6.1 vs. 3.2 miles) (9.8 vs. 5.1 km) and construction requirements (59 vs. 31 acres) (24 vs. 13 ha).

The transmission line extending from the hydroelectric plant to the proposed Moon Lake Power Plant near Bonanza would disturb approximately 69 acres (28 ha) of vegetation. The alternate power line route, terminating at a proposed Moon Lake Electric Substation northeast of Bonanza, would disturb about 74 acres (30 ha) of vegetation. All four vegetation types would be disturbed by both routes, but the impacts would be restricted to a narrow corridor and would be of minor significance. Therefore, vegetation on 3,329 acres (1,347 ha) would be disturbed by the dam and spillway, reservoir, roads, transmission line, recreation sites, and material sites. This is composed of 995 acres (403 ha) of riparian and 2,334 acres (945 ha) of upland vegetation.

MITIGATION

After the removal of embankment materials, borrow areas would be shaped to drain and blend in with the surrounding landscape. The auxiliary spillway areas would also be shaped and blended into the surrounding topography. These undisturbed areas, plus power line corridors, old road beds, the downstream side of the proposed dam, and the approach grades for the new bridge at Ignatio would be revegetated to reduce the potential erosion hazard and restore natural aesthetic quality.

Two revegetation programs would be used for the White River Dam Project: a temporary program for disturbed areas inundated by the reservoir and a permanent program for disturbed areas above the reservoir high water line or outside the immediate dam and reservoir areas. The temporary program would involve seeding with selected plant species (yellow sweet clover, barley, dryland alfalfa) which would stabilize exposed areas (except for bedrock areas) during the 2-year construction period. The permanent program would primarily involve the seeding and transplanting of native plant species which are adapted to the environmental conditions

of the project area. Due to limited precipitation, steep slopes, shallow soils, and rocky surfaces, seeding could be difficult and ineffective in certain areas.

The disturbed areas which would not be occupied by project features could be revegetated in the above manner. The loss of occupied vegetation would not be mitigated. Revegetation methodologies and adapted native species for the proposed project area are described by the Institute for Land Rehabilitation (1979a, 1979b) and are summarized in Appendix 7. In addition, the following construction practices would be adhered to:

1. Travel would be restricted to the right-of-way or established roads and trails.

2. Equipment activities would be allowed only within the right-of-way and authorized stub roads.

3. Scalping of vegetation would be minimized.

UNAVOIDABLE ADVERSE IMPACTS

About 995 acres (403 ha) of riparian vegetation and 557 acres (225 ha) of upland vegetation would be occupied by the dam and reservoir. Additional acreages of upland vegetation would be occupied by access roads, a transmission line and recreation sites, depending on which alternative would be constructed. An unquantifiable amount of additional upland vegetation would be temporarily disturbed. Even with the aid of revegetation programs, these temporarily disturbed areas could take several years (up to 20 years depending on site conditions) to return to a productivity, cover, and composition similar to that of surrounding undisturbed areas.

An unquantifiable amount of riparian-floodplain vegetation would be lost or modified along the White River below the proposed dam on 4,575 acres (1,851 ha). Removal of large acreages of riparian vegetation would have the greatest local impact since it is the most productive and ecologically important vegetation type. With the exception of the effect of extended low discharge rates from the White River Dam on downstream riparian vegetation, the majority of the proposed construction and operation activities would not seriously affect the plant communities beyond the construction and inundation zones.

THREATENED, ENDANGERED, AND SENSITIVE PLANT SPECIES

ANTICIPATED IMPACTS

Populations of a currently undescribed species of *Penstemon* would be inundated by the reservoir. Another site in the Evacuation Creek area supports this rare species. It is not fully known what the distribution of this plant is within its natural setting. This form could be rather restricted in range and abundance and therefore may be a potential candidate species for listing as endangered or threatened. A thorough review of the present population's distribution and abundance should be made to ascertain its status before construction and appropriate mitigation formulated at that time if needed.

MITIGATION

None identified at this time, although mitigation could be forthcoming as noted above.

UNAVOIDABLE ADVERSE IMPACTS

One population of *Penstemon* would be inundated.

Terrestrial Wildlife

MAMMALS

ANTICIPATED IMPACTS

The White River Dam would eliminate the habitat for the mammals presently utilizing the reservoir basin. Table 4-4 quantifies the numbers of several selected common species of game and nongame mammals that would be displaced from the 995 acres (403 ha) of riparian habitat.

The reservoir would eliminate 13.5 miles (22 km) of habitat for the estimated 176 beaver currently located in the river bottoms and would lower their numbers downstream. Lack of annual flooding would reduce cottonwood germination downstream from the dam. This would lead to decreased food availability from the dam to the Green River and decrease the beaver population in that area.

Most small rodents prefer the upland areas to the riparian, and greater densities are usually found in upland areas. Deer mice and bushy-tailed woo-

TABLE 4-4

Expected Losses or Displacements of Selected Mammals Due to Flooding of 990 Acres of Riparian Habitat on the White River

	Average Number of Resident Individuals
Beaver	176[a]
Deer Mice	25,000
Woodrats	3,200
Porcupines	26
Cottontails	189
Mule Deer	200

Source: Grant et al. 1980.

[a]Source: Cranney, 1980.

drats (packrats) are the major exceptions. These species prefer the riparian area or adjacent uplands and are most dense in these areas. When riparian habitats supported 10 deer mice/acre in 1977, desert shrub supported 1 mouse/acre and the juniper supported none (Grant et al. 1980). The upland rodent populations fluctuate directly with spring precipitation and subsequent primary production of annual plants (Beedlow et al. 1980). The permanent water in the river buffers the riparian populations from the precipitation dependence. Therefore, the loss of 13.5 miles (22 km) of riparian habitat would reduce the population of deer mice and bushy-tailed woodrats as well as the habitat buffer used by other species during drought. This loss of rodent production is important since it is an important source of prey items for carnivorous birds, mammals, and reptiles of the area.

Another rodent of consequence is the porcupine whose primary food resource is cottonwood. Most of the resident porcupine population would be eliminated in the reservoir basin. A few may emigrate to other areas.

Other species of omnivorous or carnivorous and/or fur-bearing animals which would be affected are: coyote, gray fox, ringtail, raccoon, badger, striped skunk, and bobcat. These species would lose both den sites and food resources (rodents). The bobcat and badger are protected under Utah State law.

Two game mammals in the riparian habitat, the desert cottontail and the mule deer, would be affected by the reservoir.

During the period 1975-1979 cottontail abundance in the riparian habitat was not significantly different from that in upland areas. However, when cottontail populations decline following years of low vegetation production, abundance in the riparian areas declines less sharply. This phenomenon indicates that the riparian areas act as a buffer for the populations, perhaps providing an important population pool for upland areas and stimulating recovery following poor years. Estimated direct losses in cottontail populations from the flooding of the riparian zone are shown in Table 4-4.

Cottontails are an important food source for coyotes and large raptors. The loss of this food source could reduce the local carnivore population.

Loss of 13.5 miles (22 km) of the riparian system would reduce the yearly deer-fawn production of the vicinity by 68 fawns per year (VTN Colorado, Inc. 1977). The deer herd which uses the riparian habitat in the project area is estimated at 200 individuals. The riparian area is the only suitable habitat available for their use.

As the reservoir filled, deer would be pushed out of the flooded areas into adjacent upland and upstream riparian areas. This deer use would exceed the habitat's carrying capacity for 2 to 4 years, after which deer numbers would decline to reduced levels, reflecting the capacities of the habitat.

Additional deer losses would occur in surrounding areas which presently rely on the White River riparian area for fawn production. Access road Alternative B would disturb a deer wintering area (Figure 3-7). This wintering area would be used by deer during the construction phase of the project.

The effects of the proposed White River Dam on terrestrial wildlife are summarized in Figure 4-3.

MITIGATION

The loss of rodents, cottontails, and deer within the White River Reservoir could not be mitigated. Mitigation would require reestablishment of a riparian system, which is considered by BLM to be impractical.

The USFWS has not submitted its Fish and Wildlife Coordination Act Report for inclusion in this Draft EIS. The report will be available for the Final EIS and may contain mitigation measures for deer and other wildlife species.

UNAVOIDABLE ADVERSE IMPACTS

The loss of 995 acres (403 ha) of riparian habitat would result in the loss of up to: 176 beaver; 25,000 deer mice; 3,200 bushy-tailed woodrats; 26 porcupine; 189 cottontails; and 200 deer. Unquantified additional losses to these species would occur in the riparian area along the White River below the dam. Additional unquantified deer losses would occur in surrounding areas which presently rely on the White River riparian area for fawn production.

BIRDS

ANTICIPATED IMPACTS

As a group, nongame birds would suffer the greatest losses from the flooding of the 995 acres (403 ha) of riparian habitat. Of the 126 species which inhabit the riparian system, 90 species would be either displaced or have reduced populations, 27 species would not be affected and 6 species would increase in number. An estimated 21 new species would use the reservoir, primarily shorebirds and waterfowl. Loss of the riparian habitat is more critical to birds than loss of other habitat types. In an average year in which about 600 birds would be affected in a comparable amount of juni-

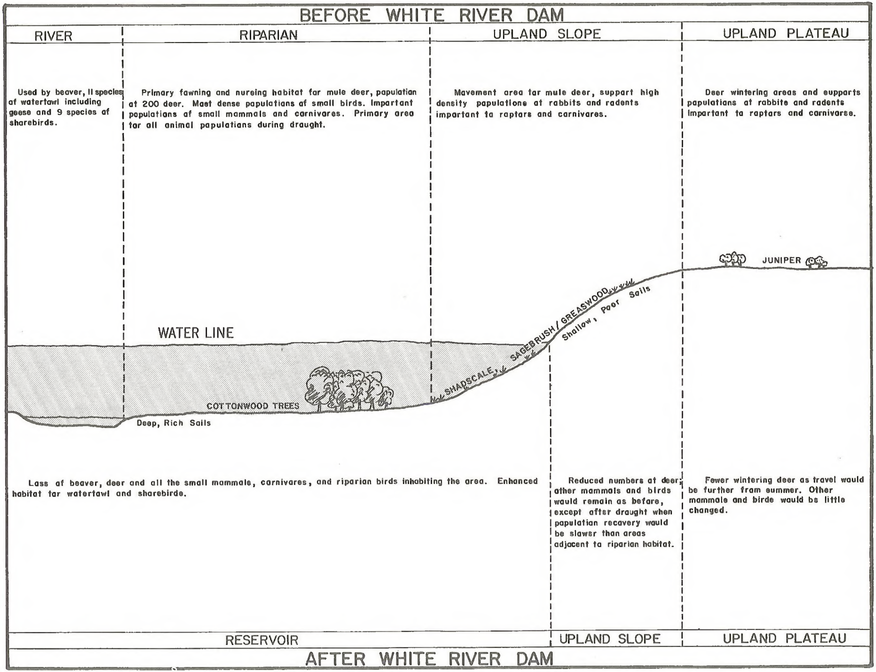


Figure 4-3
CONCEPTUALIZATION OF THE EFFECT OF THE WHITE RIVER DAM ON THE TERRESTRIAL ECOSYSTEM OF THE WHITE RIVER

per habitat and 800 affected in a comparable amount of sagebrush-greasewood, 2,200 birds would be affected in the riparian habitat. In times of peak abundance, these figures are approximately 1,400, 1,900, and 5,000, respectively. The loss of these birds would be important because they are an integral part of the riparian ecosystem.

Alternative 1 would adversely affect raptors by eliminating prey base for 14 species that hunt in the riparian habitat. Shelter and roosts for these raptors would also be lost. Those nesting species impacted for the long term would be great horned owls and Cooper's hawks. A red-tailed hawk nest would be affected during construction but no long-term effects would be expected since the next site is located above the reservoir level.

The most serious adverse impact to raptors would be the loss of prey base during drought conditions. During the 1977 drought, when upland prey base was at low density, the riparian habitat became the prime area for the raptors' food resource. Undoubtedly prey production near the reservoir shores would not equal production from the current riparian habitat.

The transmission lines could electrocute raptors which use the poles for roosting.

The reservoir would impact the Canada goose by eliminating nesting habitat for 13.5 miles (22 km) in the reservoir basin and by eliminating or reducing nesting habitat for 50 miles (80 km) to the White River's confluence with the Green River.

Surveys by the UDWR indicate that 6 nesting pairs of geese averaging 6 young per brood utilize the reservoir basin. Another 7 nesting pairs utilize the White River below the proposed dam (Drobnick 1980). Additional nonnesting adult geese also utilize these areas. Therefore, habitat for 6 nesting pairs and an annual production of 36 young geese would be lost from the reservoir basin and an unquantifiable loss of downstream habitat for nesting would also occur. An unquantifiable number of nonnesting adults would also lose summer habitat.

Game birds that would be enhanced by the reservoir are migrant waterfowl and snipe. The reservoir, based on expected turbidity and lack of emergent vegetation, would not support nesting waterfowl except in the tailwaters. Those nesting would occur at low abundance.

MITIGATION

Loss of nongame birds and raptors which use riparian habitat cannot be mitigated. Mitigation would require re-establishment of a riparian system. The transmission line associated with the proposed White River Dam would be required to be constructed to prevent electrocution of raptors. Losses to geese could be partially mitigated by intensively managing the river above and below the reservoir, i.e., providing nest platforms and construction of artificial islands for nesting geese downstream from the proposed dam.

The USFWS has not submitted their Fish and Wildlife Coordination Act Report for inclusion in this EIS. The report will be available for the Final EIS and may contain mitigation measures for geese and other birds.

UNAVOIDABLE ADVERSE IMPACTS

Nongame bird populations would be reduced due to loss of the riparian habitat. Raptors would be reduced in the general area due to loss of prey species, especially during and immediately after droughts. Loss of Canada goose nesting habitat in the reservoir basin would result in the loss of a yearly production of 36 geese. Losses of goose nesting habitat would occur downstream for 50 miles (80 km), affecting an annual production of 42 geese. Additional small but unquantifiable goose losses would be attributable to the loss of nonnesting goose habitat in the reservoir basin and below the reservoir.

THREATENED, ENDANGERED, AND SENSITIVE BIRD SPECIES

ANTICIPATED IMPACTS

The whooping crane and peregrine falcon are so transient to the area that they would not be affected. Bald eagles winter in the area. The reservoir and tailwaters which would be ice-free for a considerable distance below the dam could enhance the wintering eagles' habitat. The formal consultation for this project, as required by Section 7 of the Endangered Species Act, has not been completed by the USFWS. This consultation is continuing and the Biological Opinion will be included in the Final EIS.

MITIGATION

None.

UNAVOIDABLE ADVERSE IMPACTS

None.

Aquatic Wildlife

WHITE RIVER

ANTICIPATED IMPACTS

The White River Dam and Reservoir would impact the aquatic ecosystem in three general areas: upstream from the reservoir, within the reservoir basin, and below the dam.

The major impacts above the reservoir basin would involve the potential upstream movement of warm water fishes from the reservoir. It is doubtful that any of the fish that could be planted as game species (for example, largemouth bass and bluegill) would utilize the White River because they are lake or pond species and have been in the Colorado system for many years without becoming abundant (Holden and Stalnaker 1975).

The green sunfish, already in the White, would probably become more abundant and could create additional competition and predation for native species in the river 20 to 30 miles (32 to 38 km) above the reservoir. This phenomenon occurred in the Colorado River where ponded areas along the river are common (Holden and Stalnaker 1975; Kidd 1977).

As evidenced by past exotic introductions, most of the 8 exotic species in the White River are not abundant except for red shiners and fathead minnows. Furthermore, the number of exotic warm water species that have been introduced into the upper Colorado River system totals near 20. Only 5 or 6 of these have reproduced well and became abundant in the upper basin (Holden and Stalnaker 1975). Therefore, there is a low probability that exotic fish would change the species composition in the White River above the reservoir. The river ecosystem would still be reliant on terrestrial detritus for the initial energy input, and invertebrates would still occur in relatively small numbers.

The reservoir area of about 13.5 river miles (22 km) in length would be changed by the proposed project. The native riverine fauna would be replaced by exotic lake-pond species. This would be a positive impact from a fishery standpoint. A warm water fishery, probably bass and/or panfish, could be established in the reservoir and create a moderate fishery. The high turbidity and other problems noted in the Water Resources section would probably limit the fish productivity of the reservoir. The primary producers would be phytoplankton (algae) which would grow and live in the open water of the reservoir. They would be fed on by zooplankton, also open-water inhabitants. Lamarra (1980) indicated the lower, cooler zones of the reservoir would be lacking in oxygen, especially in late summer. Also, poisonous gases (hydrogen sulfide) could accumulate near the bottom. This factor would eliminate the possibility of a cold water (trout) fishery in the reservoir.

The area below the dam would also be changed. The cool, clear tailwater areas would show an increase in periphyton (algae), an increase in aquatic invertebrate (insect) density, and a change from a complex of native and exotic fishes to one or two trout species, probably rainbow and perhaps brown trout. This impact would be a positive impact from a fishery standpoint, but negative from the standpoint of native aquatic ecosystem maintenance. It is expected that temperatures would warm sufficiently to permit a partial native community to remain established in the lower 10-20 miles (16-32 km) of the White River, primarily by the retention of most native fishes.

It should be noted, however, that should outlet works redesign enable selective water withdrawal to maintain existing temperatures in the river downstream from the dam (as noted under Mitigation in the Water Resources section), a cold water fishery would not be possible.

Figure 4-4 illustrates the before and after effects of the White River Dam on the White River ecosystem.

MITIGATION

Assuming that fishery management agencies agree that the objective should be to maintain existing downstream temperatures, the effects of cold water releases below the dam could be partially mitigated by raising the depth of the intake structure gates to a level where summer temperatures are near 70F (22C). This would probably place the intake very near the reservoir surface (Figure 4-2), and therefore could create additional problems to power generation and the reservoir fishery. If the intake were placed too near the surface, surface debris and air bubbles could be drawn through the hydro-power generators, which could cause problems with the generators.

Also, raising the intake could cause the river to flow along the surface of the reservoir directly to the intake structure. This would reduce retention time of the surface waters which would tend to reduce phyto- and zooplankton production. This would also tend to reduce the mixing of the upper, warmer layer of the reservoir with the lower, colder layer, causing the lower layer to stagnate and become depleted in oxygen sooner than under the proposed outlet level. These changes within the reservoir would reduce its productive capability and

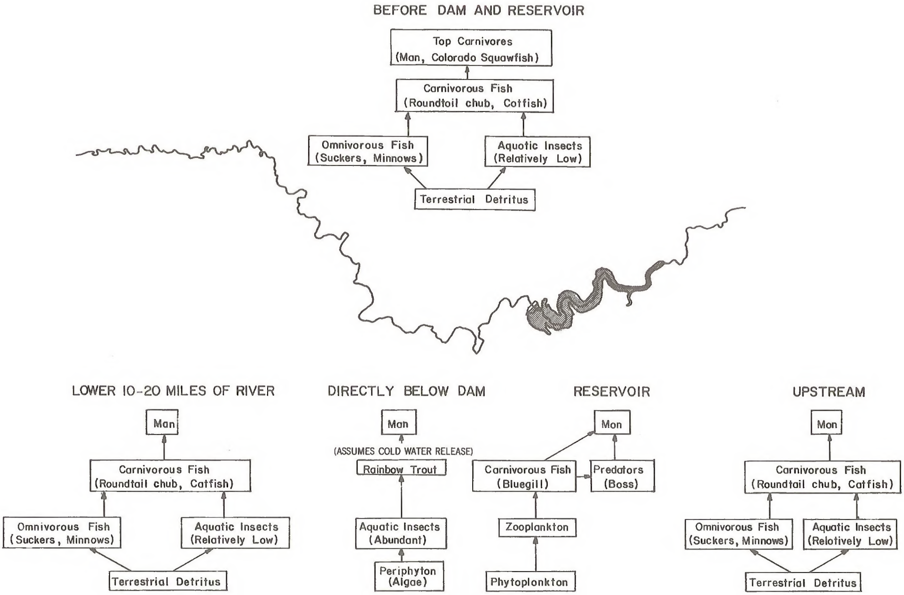


Figure 4-4

CONCEPTUALIZATION OF THE EFFECT OF THE WHITE RIVER DAM ON THE AQUATIC ECOSYSTEM OF THE WHITE RIVER

decrease the likelihood of a good warm water fishery. Increasing release temperatures would also reduce the potential of a cold water fishery below the dam.

It would be doubtful if raising the intake level would create conditions below the reservoir similar to the natural river. The water would be clear and armoring of the channel would occur. Periphyton would be abundant, as would aquatic invertebrates. Most of the native fishes, except Colorado squawfish, would be present, but exotic species could become more abundant than at present in the White River. Therefore, an increase in release temperatures would not re-establish the native ecosystem totally and hence would only partially mitigate the loss.

Additional information would be required to determine the overall feasibility of this proposed mitigation. The USFWS Biological Opinion is expected to discuss this issue; therefore, final conclusions must wait until that report is available.

UNAVOIDABLE ADVERSE IMPACTS

The native aquatic ecosystem would be lost in the 13.5 miles (22 km) of the reservoir and altered in the 50 miles (80 km) below the dam. The lower 10-20 miles (16-32 km) of the White River would maintain a partial native system, primarily native fishes with the exception of Colorado squawfish as explained below.

Threatened, Endangered, and Sensitive Fish Species in the White River

ANTICIPATED IMPACTS

The proposed White River Dam would negatively impact the Colorado squawfish in the White River by blocking potential movements up the river and by changing water quality parameters in the lower river to the extent that squawfish would not utilize the area as at present. The dam would create an effective barrier to upstream and downstream movement. Colorado squawfish have been found above the dam site, indicating that they utilize the proposed reservoir basin for movement at least. The dam would effectively cut off access to nearly half of the White River presently being used by this species.

Studies below Flaming Gorge Dam (Vanicek, Kramer, and Franklin 1970) have shown that Colorado squawfish stopped utilizing the Green River for 65 miles (104 km) below the dam after it was completed. At the 65-mile (104 km) point the Green is joined by the Yampa River, which ameliorates the water quality and produces temperature and turbidity patterns more normal for the system. Squawfish showed little utilization change below the mouth of the Yampa until 1967 or 1968, 5 to 6 years after the dam was completed. At that time, reproduction for 40 to 50 miles (64 to 80 km) below the Yampa's mouth was not evident. The cause of this change was a 100-percent increase in summer flows from the dam, which created even colder temperatures at the Yampa's mouth, and thus negated any amelioration effect on the Yampa River (Holden and Crist 1979; Holden 1980). Changes in temperature, even the relatively small change that occurred below the Yampa mouth, have affected squawfish utilization of an area. Therefore, squawfish use of the White River would be considerably reduced with the completion of the proposed White River Dam.

The importance of the White River or other tributary streams to Colorado squawfish is not fully known. At present the White is one of only three tributary streams in the upper Colorado basin still used to some extent by this endangered species. The other two are the Yampa and Duchesne Rivers, also tributaries of the Green River. The flows of the Duchesne River will be depleted by completion of the Central Utah Project, presently under construction (USDI, WPRS 1979), which could make it less suitable for squawfish. This means the loss of the White River could reduce the number of tributaries remaining to the Colorado squawfish throughout the entire Colorado River system to one, the Yampa River. Since squawfish use these tributaries, and until contrary information is gathered, the White River must be considered important to this endangered species. In summary, the loss of the White River would reduce the usable number of tributaries remaining in the upper Colorado basin, which would be a serious impact to Colorado squawfish.

Since only one specimen of both the humpback and bonytail chubs have been found in the White River (see Chapter 3), impacts to these species would be minor.

As previously noted, the USFWS Biological Opinion on this project has not been completed to date. It will be included in the Final EIS.

MITIGATION

The blockage of the channel posed by the dam could not be mitigated. A release of warmer temperatures approximating natural levels could reduce the impact on water quality as discussed above for the nonendangered aquatic ecosystem, but squawfish utilization of the White River would probably

still be seriously impacted. Studies below Flaming Gorge Dam after water temperatures were increased have not shown increased utilization by Colorado squawfish (Holden and Crist 1979, 1980).

UNAVOIDABLE ADVERSE IMPACTS

All of the impacts associated with blockage of the channel and change in water quality in the White River aquatic ecosystem would be unavoidable with regard to Colorado squawfish. No impacts on bonytail chub, humpback chub, or razorback sucker are expected in the White River because of low use of the White River by these species.

GREEN RIVER

ANTICIPATED IMPACTS

The White River Dam and Reservoir would impact the aquatic ecosystem of the Green River by reducing flows below the mouth of the White River and by decreasing temperatures slightly. It is doubtful these actions would change the aquatic ecosystem significantly. The Green would remain turbid and periphyton and aquatic invertebrates would remain in low abundance. The fish population would be the most affected. Flow reduction could change the available habitat in the Green River to favor exotic species more than native species. It is doubtful the depletion in flow from the White River Dam alone would create serious changes. The cumulative effect of flow depletions from the proposed White River Dam, as well as other proposed projects in the upper basin, could cause changes in the fish fauna. This cumulative impact will be elaborated on in a later section. The slight reduction in temperature which would be created by the dam in the White River would probably not be measurable once the White River water was mixed with the larger Green River.

MITIGATION

The proposed White River Dam would not adversely affect aquatic habitat of the Green River by itself. However, the cumulative loss of 70,000 acre-feet of water from this project and a number of other proposed projects could cause the aquatic ecosystems of the Green River to change significantly.

UNAVOIDABLE ADVERSE IMPACTS

Unavoidable adverse impacts to the Green River have been attributed to the White River Dam by itself.

Threatened, Endangered, and Sensitive Fish Species in the Green River

ANTICIPATED IMPACTS

The major impact of the White River Dam on the Green River would be a loss of flow. A number of studies have shown that loss of flow has negatively impacted the Colorado squawfish and bonytail chub. The bonytail has been the most seriously affected by flow depletions. Vanicek, Kramer, and Franklin (1970) found nearly 100 bonytails in the Green River below Flaming Gorge following closure of the dam. All of these fish were adults from year classes prior to dam closure. Holden and Stalnaker (1975) sampled the same area after Vanicek's study and found only 36 adult bonytails. Holden (1975) searched collections of several hundred juvenile chubs collected in 1964-1966 and 1968-1971, but found only 3 possible bonytails. He concluded that bonytail chub population size and reproduction had decreased dramatically in the upper Green River following closure of Flaming Gorge Dam.

These data from the upper Green River, in conjunction with information from throughout the upper Colorado basin showing the rarity of this species, indicate that bonytail chubs have been seriously impacted by the major dam construction of the 1960s. The most likely factor causing the decline is reduced flows because water quality and temperature patterns appear to be acceptable to other native species in areas removed from direct impacts of the dams (Holden 1980). Any increase in flow reduction to the Green River could lessen the chance that this species may survive (Holden 1980). This species is already the rarest native species in the upper Colorado basin and may well be on the verge of extinction.

Flows in the Green River have also been shown to be very important for the survival of Colorado squawfish (Holden 1980). Squawfish did not reproduce well in 1977, a drought year, in the upper Green River. They did reproduce in 1975, 1976, 1978, and 1979, which were more normal flow years.

Squawfish do not appear to be as successful in reproducing in the Colorado River of Colorado and Utah as they are in the Green River of Utah (Holden and Stalnaker 1975, Kidd 1977). Joseph et

al. (1978) indicated that May flows in the Colorado River have been depleted below historic low levels since the early 1960s, whereas flows of the Green River have not been depleted below historic low levels. Both areas contain many dams but the Green River still has the Yampa and White Rivers as free-flowing tributaries in addition to releases from Flaming Gorge Reservoir, and therefore still retains a more natural flow level. It is not known how much additional depletion can occur on the Green River before Colorado squawfish reproductive success declines. It is possible the rather small depletion caused by the proposed White River Dam could be sufficient in itself to jeopardize the species. This is unlikely, but the cumulative effect of several planned water withdrawals appears most certainly to be a major threat to this endangered species.

Sufficient data is not available to assess the impact of the project on humpback chub or razorback sucker. There is not sufficient information available that indicates these species have suffered from flow depletion. Data is available that indicate they have been eliminated below dams releasing cold water (Vanicek, Kramer, and Franklin 1970). Recent collections by the USFWS in the Colorado River above Grand Junction have located a population of humpback chubs (Valdez, 1980). This area, which is above the mouth of the Gunnison River, a major tributary, experienced flow depletions starting in the late 1800s. This population of humpback chubs needs further examination but its existence indicates that, if appropriate habitat is maintained, this species is not seriously affected by some levels of flow depletion. This also suggests that the humpback chub can tolerate greater flow depletions than the bonytail or Colorado squawfish, at least in some areas.

The lack of obvious reproduction for the razorback sucker may be a result of flow depletions since the 1960s. The razorback sucker is a long-lived fish, reaching at least 25 to 30 years in some areas (Minckley 1973). This may mean that the adults presently being captured in the Green River were all spawned before Flaming Gorge Dam was completed, and that no reproduction has occurred since before 1962. This hypothesis cannot be proven or disproven with available data. Hopefully the studies presently being undertaken by the USFWS will help clarify this problem.

The White River Dam would also decrease temperatures in the Green River very slightly during summer months. It is doubtful this would be a major problem because the change in temperatures would be very slight, perhaps unrecordable 10 miles or so below the White's mouth.

As indicated above, the Biological Opinion as required under Section 7 of the Endangered Species Act, has not been completed. It will be included in the Final EIS.

MITIGATION

Some mitigation of flows is possible by releasing additional water from Flaming Gorge Dam to make up for the loss of flow in the White River. This would be reasonable during low flow periods when little of the White River flow is depleted. It would be much more difficult during high flows when considerable water is depleted. Considerable coordination would be required to assure that day-to-day flows were not depleted. This mitigation would only mitigate the depletions of this project, not the cumulative depletions of all potential projects.

UNAVOIDABLE ADVERSE IMPACTS

The cumulative loss of flow in the Green River by this project and other proposed water developments in the Green River system could reduce flows sufficiently to jeopardize the continued existence of the bonytail chub and Colorado squawfish, and perhaps the humpback chub and razorback sucker.

Recreation

WATER ORIENTED: FISHING, CANOEING, AND RAFTING

ANTICIPATED IMPACTS

The present limited channel catfish fishery would be lost below the reservoir and to some extent within the reservoir. Since this is a very limited and little utilized fishery, adverse impacts would be minimal. Beneficial fishing impacts would include the development of a cold water (trout) fishery below the dam in the White River (if cold water releases occur) and the proposed development of a warm water fishery in the reservoir itself. Lamarra (1980) indicated the warm water fishery would probably be of low quality, thus not adding greatly to the recreation resource. Pelican Lake, located closer to the Wasatch Front and approximately the same distance from Vernal as the proposed White River Dam alternative, currently provides a quality warm water fishery. It is not possible to predict the numbers of fishermen who would use the reservoir or tailwater until the fishery is established. In any

case, the gain in sport fishing associated with construction of the reservoir would more than offset the loss sustained to the channel catfish fishery.

The quality of canoeing and rafting currently experienced would be reduced in the 13.5 miles (22 km) of reservoir, which would become flat water. Since the portion of river to become reservoir is used by only a small number of boating parties (less than 20 per year) the effects in the short run would be minor. Canoeing and rafting below the dam could still continue as flows would not be reduced sufficiently in normal years to seriously affect this activity. During dry years, the flow depletion could produce a less desirable river level.

The availability of the reservoir for power boating could be a beneficial impact of this alternative, although algal blooms and hydrogen sulfide gas released during spring overturn (Lamarra 1980) could reduce the value of the reservoir for boating and related activities because of the unpleasant odors. There are presently many boating opportunities within the Uinta Basin and at Flaming Gorge. It is doubtful the White River Reservoir would significantly add to the boating resources of the region.

MITIGATION

The loss of 13.5 miles (22 km) of canoeing stream cannot be replaced but the loss of recreation would be mitigated in other forms by the opportunities the reservoir would provide. Proposed access road below the dam could provide ready access for canoeists and others floating the river downstream from the dam.

UNAVOIDABLE ADVERSE IMPACTS

Thirteen and one-half miles (22 km) of canoeing stream would be lost.

LAND ORIENTED: CAMPING, ORV'S, AND HUNTING

ANTICIPATED IMPACTS

Adverse impacts would be limited to the loss of a few primitive undeveloped sites along the White River and those associated with the old bridge at Ignatio. These impacts would be insignificant. If the campground at Ignatio slated for future development were constructed, it would mitigate the loss of the primitive sites. There would be some short-term effects due to dam construction.

Portions of the primitive access roads to the White River in the project area would be lost to ORV users. This would not be much of an adverse impact due to very low use and the abundance of similar public lands open to ORV use in the immediate vicinity.

Construction of the dam and reservoir would have adverse effects upon deer hunting, due not only to the loss of habitat which supports an estimated 200 deer, but also to the loss of fawns produced in the area which then emigrate elsewhere. The loss of 200 huntable deer would result in the loss of 936 hunter days per year using the average deer hunt success data collected by the UDWR for this region. An additional unquantifiable number of hunter days would be lost due to the absence of those deer fawned along the White River who emigrate elsewhere.

The reservoir may better serve waterfowl hunters than the natural system does now by attracting migrating waterfowl during the hunting season. This increase in waterfowl hunting is unquantifiable.

A small but unquantifiable loss of goose hunting would occur due to the loss of 29 geese in the reservoir area and additional geese below the dam. The geese in this area move to unknown areas before hunting season.

Activities at the material source sites would have limited, short-term effects upon the recreation resources of the project area due primarily to dust, noise, and human activity. Watering to control dust, as proposed by the applicant, would mitigate most of the negative effects due to dust.

The roads proposed for construction would provide better access to the river below the proposed dam and the reservoir, thus resulting in overall recreation benefits.

MITIGATION

The loss of deer and goose hunting opportunities could be mitigated if the deer and geese population losses would be mitigated. Viable mitigation for the loss that would be sustained by the populations of these species would be difficult (see Terrestrial Wildlife section); therefore, the hunting losses would also be difficult to mitigate.

UNAVOIDABLE ADVERSE IMPACTS

Up to 936 hunter days per year for deer would be lost in the State of Utah, along with a small but unquantifiable loss in hunter days for geese.

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Visual Resources

ANTICIPATED IMPACTS

Construction of the White River Dam would affect the visual quality of the project area. The site of the dam and reservoir is currently placed by BLM in Visual Resource Management Class II, the highest assigned to any portion of the Bonanza Planning Unit (see Appendix 6). Management objectives would not be met along the stretch of river affected by the proposed dam and ancillary facilities.

The period of construction would be the period of greatest visual effect at the dam site. The material sites would be located out of the line of sight so visual impacts would be minor. All areas disturbed for access roads, transmission lines, material sites, and recreation sites would decrease the visual quality of site specific areas.

There would be little difference between the two suggested roads to the dam site on the north side of the river (Alternatives A and B) in terms of visual impact, since both follow existing roads and are not highly visible from other roads. Upgrading of the present Wagon Hound road (Utah 45) and construction of a new bridge at Ignatio (Alternative D) would result in short-term effects due to dust and the loss of vegetation.

Alternative E (access road) would result in greater visual impacts than Alternative D since it involves the construction of 6.1 miles of new road and a suspension bridge which would be much more visible than the bridge at the Ignatio site which is located in less exposed, lower terrain. Either of the power line alternatives would have an impact on the character of the landscape. The greatest visual impact would be in the first 4 or 5 miles of the transmission line, near the proposed dam.

MITIGATION

Many of the potential visual effects during the construction phase of the project could be mitigated by the control of fugitive dust with water. Material sites and disturbed areas adjacent to new roads, transmission lines, and recreation sites would be revegetated. All temporary roads would be obliterated and revegetated when they are no longer needed. Scars would remain for approximately 15 years until revegetation would become fully established. If the access road across the White River (Alternative E) were selected, the new bridge would be painted to blend with the existing environment. The power lines would be of nonspecular cable.

UNAVOIDABLE ADVERSE IMPACTS

Current BLM Visual Resource Management objectives would not be met.

Land Uses, Plans, and Controls

DOMESTIC LIVESTOCK GRAZING

ANTICIPATED IMPACTS

About 47 percent of the livestock forage within the White River Bottoms cattle allotment would be inundated by the proposed reservoir. The loss of forage on Federal land would be 103 animal unit months (AUMs); while 270 AUMs would be lost on State and private lands.

There would be little grazing loss resulting from the removal of material from the various sites for dam and road construction, or from the construction of access roads, transmission lines, and recreation sites.

MITIGATION

Forage would be lost due to material sites, access roads, transmission lines; and recreation sites would be eliminated. Part of the loss would eventually be mitigated through revegetation. The loss of grazing on private and Ute Indian lands would be compensated for through arrangements made by the Utah Division of Water Resources with the individual land owners.

UNAVOIDABLE ADVERSE IMPACTS

A loss of forage for 23 cattle grazing 4.5 months on public lands would occur each year within the White River Bottoms cattle allotment. This reduction in livestock production would cause an economic loss to the rancher.

WILDERNESS

ANTICIPATED IMPACTS

There would be no adverse impact upon the wilderness resource of the area since the project area has been rejected for further wilderness study.

MITIGATION

None.

UNAVOIDABLE ADVERSE IMPACTS

None.

WILD HORSES

ANTICIPATED IMPACTS

The dam and reservoir would have no effect on wild horses in the area since they inhabit the bench areas not the river bottoms. The displacement of wild horses during power transmission system construction would only be temporary and not significant. The horses would return to their natural range within a few weeks after construction was completed.

MITIGATION

None.

UNAVOIDABLE ADVERSE IMPACTS

None.

LAND USE PLANS: BLM

ANTICIPATED IMPACTS

The White River Dam Project would result in little conflict with the majority of the BLM Management Framework Plan (MFP) except in the case of the recreation portion of the Plan for the Bonanza Planning Unit. Incompatible uses or developments on or adjacent to inventoried archaeology sites in the unit are not allowed. Since some known sites would be flooded and/or disturbed by construction, this portion of the plan would be violated. Also, there would be a conflict with the visual classes assigned to the Unit as indicated above.

The Bonanza Plan also calls for nonallowance of surface disturbances which would detract from the natural environment. The dam and reservoir and resulting road construction and material site development would be in conflict with the plan.

The plan calls for excluding ORV use adjacent to the White River. Improved access to the river would increase ORV use in this area.

MITIGATION

None.

UNAVOIDABLE ADVERSE IMPACTS

The current Bonanza MFP would not be met.

Cultural Resources

ANTICIPATED IMPACTS

There are 21 known prehistoric and historic sites in the study area which would be impacted as a result of either construction or inundation of the White River Dam and Reservoir. Construction activities would alter, damage, or destroy surface and subsurface cultural data, as would reservoir inundation or wave action. Three known prehistoric sites would be impacted by removing soils from material sites north of Bonanza. Since only about 25 percent of the designated borrow areas have been inventoried, additional cultural resource sites are likely to occur in those locations.

An increase in access to the area and resultant recreational activities could result in future indirect impacts to known cultural resources due to vandalism.

In short, any alteration, damage, or destruction of these resources could result specifically in one or more of the following:

1. Loss of scientific and cultural information.
2. Loss of physical expression of the resource.
3. Loss of the resource for future research.
4. Loss of resources that may have important cultural affiliations.
5. Loss of artifact material.

MITIGATION

The loss of cultural resources and data would be partially mitigated through consultation between the managing agency and the State Historic Preservation Officer to determine the most appropriate means of lessening the impacts. The primary methods for mitigation include the following:

1. A complete cultural inventory of those areas affected by the project which have not been totally inventoried.
2. Avoidance of known cultural resource sites by construction and related activities.

3. If avoidance is not prudent or feasible, a site-specific data recovery plan would be undertaken for selected sites.

A Memorandum of Understanding for this project has been arranged between BLM and the Utah State Historic Preservation Officer.

UNAVOIDABLE ADVERSE IMPACTS

Although all project areas would be surveyed for cultural resources prior to any surface disturbances to ensure that no significant prehistoric or historic sites would be damaged, it is possible that some unquantifiable cultural resources having no surface manifestations could be destroyed or damaged during construction activities. Increased ease of access and use of the area could increase the potential for vandalism of archaeological sites.

Human Resources

ANTICIPATED IMPACTS

The effect of the White River Dam construction and operation on human resources would be both brief and relatively insignificant, particularly in the face of the rapid growth which is both current and projected in the area. A high of 50 construction jobs and a low of 15 jobs would be required through the first 2 years for construction of the dam, and 15 to 20 jobs would be required for the following 2 years for construction of the power plant (Utah Division of Water Resources 1979). After construction was completed, 3 permanent jobs would be sufficient for operation. In addition, the Utah Division of Water Resources (1979) suggested that all jobs would be filled from the local population of Vernal. It is likely, however, that if the area's economic growth continues as predicted, labor would have to be imported. Thus, five assumptions were made:

1. Seventy percent of the jobs would be filled from nonlocal labor.

2. Indirect employment would be 25 percent of the nonlocal workers.

3. Nonlocal indirect labor would be 45 percent of the indirect labor.

4. Single workers would make up 50 percent of the nonlocal construction labor force and 20 percent of the nonlocal indirect labor.

5. Married workers would have a family size of 3.58.

Table 4-5 indicates predicted direct and indirect employment. If all construction employment were local, only the indirect nonlocal employment would be expected.

Using the above assumptions, population could be expected to temporarily increase in the region by approximately 94 persons at most, a less than 1-percent increase (Table 4-5). Housing needs were calculated using 0.75 dwelling unit per employee for construction workers, and the percentages of housing demand by type. It is anticipated that the existing mobile home parks would accommodate most of the construction workers. Thus, the impact on housing demand would be minimal (Table 4-6).

Some reservations should be kept in mind with respect to these projections. First, although all the impact is predicted to be in Vernal, Utah; Rangely, Colorado, could experience up to 20 percent of the increased population.

Per capita income would likely increase slightly if all workers were local, although the impact would likely be insignificant compared to normal fluctuations for the period of construction. The demand for educational services, law enforcement, health service, financial services, and fire protection would not be expected to increase significantly, particularly with respect to impacts of other probable projects. Using industry injury rates for earth dam construction, there is approximately one disabling injury or death per 2,400 man years, and about 8 man-days lost time per year. Thus, the White River Dam would have less than one disabling injury, and approximately 1,120 lost days due to work-related injury over the 4-year construction period, using the maximum employment figures given above (USBR 1974).

It is doubtful that significant erosion of local cultural attributes would occur as a result of the White River Dam. In fact, if local labor force were used, no change would be expected. Even under the maximum immigration assumption, the impacts on communities would likely be of short duration and so spread over time as to be negligible.

It is noted, however, that if the White River Dam were to be constructed at the same time as other interrelated projects (such as the Moon Lake Power Plant), it would contribute to cumulative socioeconomic impacts in the region.

MITIGATION

None.

TABLE 4-5

White River Dam Employment and Population Impacts

	First 2 Years		Second 2 Years		
	High	Low	High	Low	Permanent
Total Employment	50	15	20	15	3
Nonlocal Workers	35	11	14	11	2
Indirect Employment	9	3	4	3	1
Nonlocal Indirect	4	1	2	1	0
Nonlocal Population					
Single	19	6	7	6	1
Household	75	22	29	22	4
Total	94	28	36	28	5

TABLE 4-6

White River Dam Housing Demands

	First 2 Years		Second 2 Years		
	High	Low	High	Low	Permanent
Construction Demand					
Single Family	9	3	5	3	3
Apartment	2	1	1	1	0
Mobile Home	12	3	7	4	0
Other	3	0	2	0	0
Total	26	8	15	8	3
Indirect Demand					
Single Family	2	1	1	1	1
Apartment	0	0	0	0	0
Mobile Home	1	0	1	0	0
Other	0	0	0	0	0
Total	3	1	2	1	1
Total Housing Demand					
Single Family	11	4	6	4	4
Apartment	2	1	1	1	0
Mobile Home	13	4	8	4	0
Other	3	0	2	0	0
Total	29	9	17	9	4

UNAVOIDABLE ADVERSE IMPACTS

None.

ALTERNATIVE 2: NO ACTION

If the proposed project or its alternatives were not implemented, the environmental impacts associated with construction and operation would not occur. The existing environmental and socioeconomic trends of the project area would be expected to continue. The water resources proposed for development would still be available for future uses in the Colorado River system (i.e., agriculture, fish habitat, municipal-industrial).

Significant impacts to localized populations of game animals are expected as energy development continues. The majority of those impacts is expected from increased hunting pressure of a larger human population and losses in habitat. The general aquatic and terrestrial systems associated with the White and Green Rivers are expected to remain stable, as degradations in habitat are countered by mitigative measures required of developmental activities.

The rural nature of the Uinta Basin and the present quality of life would change as energy development continues. Some of the present social problems faced by the local communities would be aggravated, although an increased tax base would help alleviate many of the worst problems.

The alternative of "No Action" would require the users of the water developed by the proposed alternatives to seek other means of supplying water. If no water were made available from surface sources, other sources, primarily groundwater, would need to be investigated more intensely. Conservation and reuse of water during oil shale processing and other potential uses would need to be investigated to a greater depth than at present. The unavailability of water could seriously affect the planned energy development in the project area.

The Uinta Basin presently has several recreational sites available; however, more demand for recreational opportunities is expected as population size increases. With the increased cost of travel, however, local sites may be utilized less by tourists and long distance travelers, and hence become more available to the local population. ORV use and hunting could increase significantly.

Recent water development in the Uinta Basin area has been extensive. Flaming Gorge Dam was completed in 1962. The Central Utah Project has a number of completed reservoirs and others are in the development stage on tributaries of the Green and Duchesne Rivers. Demands for water along the White and Green Rivers are expected to increase, primarily due to continued oil shale development. Even with these and other energy-related demands, it is doubtful the rate of water development in the Uinta Basin area will continue at its recent high rate, perhaps for no other reason than most feasible areas have already been developed or are planned for development. The loss of flows in the Green River system due to present development would definitely cause greater concern for the endangered fishes and other wildlife associated with this stream.

ALTERNATIVE 3: PUMPING FROM THE WHITE RIVER AND AUGMENTING FROM HELL'S HOLE CANYON RESERVOIR

Minerals

ANTICIPATED IMPACTS

The Hell's Hole Canyon Reservoir would inundate a portion of one oil and gas lease, one unpatented mining claim, and a portion of potentially recoverable oil shale. The reservoir would probably not seriously affect the oil and gas lease, but would result in the inability to mine an unquantifiable amount of oil shale resource.

MITIGATION

The adverse impacts associated with the oil shale claims would have to be mitigated by compensation or other arrangements with the lease holders by the Utah Division of Water Resources prior to construction.

UNAVOIDABLE ADVERSE IMPACTS

Some loss of oil shale recovery would occur on about 295 acres (119 ha).

Paleontology

ANTICIPATED IMPACTS

Construction activities associated with this alternative and inundation by the reservoir could disturb the position and relationships of fossils and result in the loss of scientific and educational values. The greatest impact would be in those formations with potential for high paleontological significance (Green River Formation). Road improvements and construction, borrow removal, power line and pipeline construction, etc., could all directly impact fossil materials. A total of about 315 acres (127 ha) would be disturbed. Because construction activities associated with this alternative would be confined to the Green River Formation, the paleontological impact would probably not be severe because of the relative abundance of typical plants and invertebrates in this formation.

Increased collecting and removal of known fossils in the region would likely result from increased numbers of people associated with the proposed project. Such activity is impossible to quantify but scientifically important fossils could be removed from location without proper documentation of information. Scientific and educational values would be lost.

MITIGATION

The applicant would obtain the services of a qualified paleontologist who would be approved by the appropriate Federal official. The paleontologist would conduct an intensive survey of all areas to be disturbed which have high potential for paleontological resources. The paleontologist would be available, as needed, during surface disturbance. If the paleontologist determined that paleontological values would be disturbed, construction would be halted until appropriate records or salvage action could be taken.

UNAVOIDABLE ADVERSE IMPACTS

Even with the suggested mitigation, some unavoidable loss of fossils potentially important to science could occur in 315 acres (127 ha). It is unlikely any such loss would be of great significance to the human environment as a whole.

Soils

ANTICIPATED IMPACTS

The soil depth of the Hell's Hole Dam and Reservoir area ranges from extremely shallow to nonexistent. Much of the area has small pockets of soil intermixed in a loose arrangement of fractured rock. The steepness of the canyon and low density vegetational cover have probably contributed to a rapid natural erosion of fine particles as they are formed. Therefore, the erosion potential of this area is generally low, simply due to lack of soil. Erosion would occur in areas of construction where soil is exposed, especially during construction of an access road down to the canyon floor. This would occur in less than 100 acres (40 ha) of disturbed soil.

MITIGATION

The mitigation suggested in the Soils section of Chapter 4 for the White River Dam (Alternative 1) would be utilized in disturbed areas with sufficient soil.

UNAVOIDABLE ADVERSE IMPACTS

A small amount of soil would be lost by erosion from disturbed areas.

Water Resources

ANTICIPATED IMPACTS

No significant impacts are expected upon groundwater, wetlands, or floodplains as a result of developing this alternative.

Implementation of this alternative would result in the depletion of certain amounts of water from the White and Green Rivers, as indicated in Tables 4-2 and 4-3. These depletions would arise as a result of satisfying the requirement of 70,000 acre-feet (97 cfs) of water assumed needed for energy development.

Under this alternative, water would be pumped from the White River and augmented by releases from Hell's Hole Dam as necessary to meet the requirement. An examination of the 48-year period of record (1931-1978) indicated only 1 year (Water Year 1977) when augmentation would have been necessary. Therefore, under "normal" conditions, Hell's Hole Dam would not be utilized as a water source. Evaporative losses from the reservoir would

average about 750 acre-feet per year, which would be made up annually by pumping from the White River. Because this would be a very small depletion, it (evaporation) was not included in Tables 4-2 and 4-3.

If potential upstream water development occurs in Colorado, the storage from Hell's Hole Canyon Dam would be used more frequently, perhaps as often as every year during the drier months (July-October) because instream flows would be reduced. Since the quantity of future upstream uses is not known, it is not possible to quantify their effects on the Hell's Hole Canyon Alternative.

The "worst case" situation in the period of record occurred during Water Years 1976-1978. Table 4-7 provides an indication of water availability and reservoir storage values during this period. Note that even augmentation with water from Hell's Hole Dam fails to satisfy the requirement during a 5-month portion of this period.

These depletions would not affect downstream water rights and would be part of Utah's share of the Colorado River Compact waters.

Depletion of this quantity of water from the White River would be expected to cause an increase in salinity of approximately 3.4 mg/l in the Colorado River at Imperial Dam, California (USBR 1974). Annual costs of salinity increases are estimated to be $430,000 per mg/l increase at Imperial Dam (Clinton 1980).

MITIGATION

None.

UNAVOIDABLE ADVERSE IMPACTS

The White and Green River systems would be depleted by 70,000 acre-feet per year and salinity at Imperial Dam, California, would increase by 3.4 mg/l. This salinity increase would create an annual loss of $430,000 per mg/l.

Vegetation

ANTICIPATED IMPACTS

An estimated 44 acres (18 ha) of sagebrush-greasewood and shadscale vegetation would be eliminated by construction of the Hell's Hole Canyon Dam and associated structures. The reservoir would inundate an additional 260 acres (104 ha) of sagebrush-greasewood and shadscale vegetation at the normal surface water elevation. The potential loss of productivity would be of local importance to wildlife and livestock.

The majority of the dam embankment materials would be obtained from the reservoir area. These disturbed borrow areas, in sagebrush-greasewood and shadscale vegetation types, would be inundated by the reservoir or covered by the dam complex. If sufficient borrow material were not available in the reservoir area, other borrow areas would probably be selected farther up Hell's Hole Canyon in sagebrush-greasewood, shadscale, and juniper vegetation types. The acreages disturbed would depend on the amount of borrow material required.

The water diversion and pumping facilities for this alternative would have a permanent impact on about 0.5 acres (0.2 ha) of riparian vegetation at the mouth of Hell's Hole Canyon on the White River. The pipeline from the pumping station to the base of the dam would disturb a narrow corridor of approximately 2.5 acres (1.0 ha) of riparian and sagebrush-greasewood vegetation.

Considerable construction on steeply sloped juniper and shadscale areas would be required to provide access and power to pumping facilities. Construction along this common corridor would not eliminate a large acreage of existing vegetation, but it could influence surrounding vegetation by increasing the potential erosion hazard. Relocating the existing road in the upper end of the reservoir would also eliminate a small acreage of shadscale and juniper vegetation.

Most of the Hell's Hole Canyon area is very sparsely vegetated. Since all but about 0.5 acres (0.2 ha) of the 339 acres (137 ha) disturbed or inundated would be upland vegetation, the impacts to vegetation would be minor.

MITIGATION

Disturbed dam construction areas, borrow areas, the downstream side of the dam, power line route, water pipeline, and access road corridors would be revegetated in the same manner as described for disturbed areas in the White River Dam Alternative.

UNAVOIDABLE ADVERSE IMPACTS

Loss of 0.5 acres (0.2 ha) of riparian and 339 acres (137 ha) of upland vegetation would occur.

TABLE 4-7

Availability of Water From White River During the Driest Years of Record[a]

	Observed discharge at Watson (cfs)	Water available for energy development[b] (cfs)	Augmentation required[c] (cfs)	Storage in Hell's Hole Reservoir (acre-feet)
June 1976	1,203	953	-	Full
July	364	114	-	Full
Aug.	337	87	10	24,385
Sep.	287	35	62	20,695
Oct.	384	134	-	22,971
Nov.	345	95	2	22,852
Dec.	293	43	54	19,531
Jan. 1977	320	70	27	17,870
Feb.	349	99	-	17,981
Mar.	395	145	-	20,933
Apr.	412	162	-	24,802
May	384	134	-	Full
June	264	14	83	20,060
July	140	0	97	14,210
Aug.	207	0	97	8,360
Sep.	212	0	97	2,610
Oct.	270	20	77	Empty
Nov.	311	61	36	Empty
Dec.	277	27	70	Empty
Jan. 1978	299	49	48	Empty
Feb.	306	56	41	Empty
Mar.	457	207	--	6,766
Apr.	603	353	--	22,004
May	1,514	1,264	--	Full

[a]Based on scenario of how project would have been operated had it existed during the 1976-1978 period.

[b]After depletion of 250 cfs (see Appendix 3).

[c]Amount needed to meet energy development requirement of 97 cfs.

THREATENED, ENDANGERED, AND SENSITIVE PLANT SPECIES

There are no known threatened, endangered, or sensitive plant species inhabiting the Hell's Hole Canyon construction area. Therefore, there are no impacts associated with this environmental element.

Terrestrial Wildlife

ANTICIPATED IMPACTS

The Hell's Hole Canyon Dam would eliminate the habitat for the birds and mammals using the reservoir basin. No specific data are available for Hell's Hole Canyon on animal abundance. Numbers of rodents and small birds are expected to be low due to the sparse upland vegetation. Therefore, impacts to these small animals, and the larger carnivores which feed on them, would be minor.

Mule deer use Hell's Hole Canyon as an access route between the riparian habitat along the White River and the upland wintering areas. The dam and reservoir would alter some of the movement patterns but would leave some access routes available to the deer. Therefore, adverse impacts to deer would be minor.

The reservoir could, in fact, enhance the general area for mammals, especially deer and small rodents requiring frequent access to water, by providing offstream water. Frequent drawdown of the reservoir would eliminate most of the beneficial effects to mammals, as the water supply would not be consistently available except near the dam.

Waterfowl numbers would also be increased due to the ponded aquatic habitat. Some of these species would nest in the reservoir, primarily in the shallow, upper portion of the reservoir. The number of waterfowl that would utilize the area is not known, but would be low if the reservoir fluctuated greatly each year.

MITIGATION

None.

UNAVOIDABLE ADVERSE IMPACTS

None.

Aquatic Wildlife

WHITE RIVER

ANTICIPATED IMPACTS

Alternative 3 would reduce the flows of the White River by a fairly constant 97 cfs (70,000 acre feet/year). This represents from 25 to 30 percent of the normal low flow levels and about 5 to 10 percent of the normal high flow levels (Table 4-2). During drought periods, the percent of depletion increases slightly but never exceeds 35 percent due to the assumption that 250 cfs, or the flow of the river if below 250 cfs, would not be utilized. No changes in the aquatic ecosystem of the White River would occur due to this loss of flow, primarily because the sand-silt substrate of the river would not change dramatically, hence aquatic habitat would not be altered.

During periods when water is released from Hell's Hole Canyon Dam, summer water temperatures in the White River below Hell's Hole Canyon would be reduced. Since this would occur only sporadically and for relatively short periods of time, no significant impact is expected.

The major impact of the Hell's Hole Canyon Project on the White River aquatic ecosystem would be the cumulative loss of flows of this project and other potential future projects on the White River. Loss of flows could create habitat conditions that could favor exotic fishes over the native species. Cumulative impacts are discussed in a later section of this chapter.

MITIGATION

None.

UNAVOIDABLE ADVERSE IMPACTS

The cumulative loss of 70,000 acre-feet of water from this project and additional depletions from other future projects on the White River could cause a loss of the native aquatic ecosystem in the White River.

Threatened, Endangered, and Sensitive Fish Species in the White River

ANTICIPATED IMPACTS

The reduction in flow in the White River would not be expected to seriously affect utilization of the river by Colorado squawfish. It is known that squawfish do not use tributary streams considerably smaller than the White River to any extent. Whether this reduction in flow would create a similar non-preferred situation in the White River is not known, but thought unlikely. Therefore, the Hell's Hole Canyon Project would not adversely impact endangered fish utilization of the White River by itself.

The cumulative loss of flows in the White River from this project and other future projects could eliminate the White River as squawfish habitat due to insufficient flow.

As indicated previously, the formal Section 7 Consultation Biological Opinion for this alternative has not yet been released by the USFWS.

MITIGATION

None.

UNAVOIDABLE ADVERSE IMPACTS

The cumulative loss of flows in the White River from this project and other future projects could eliminate the White River as squawfish habitat due to insufficient flow.

GREEN RIVER

ANTICIPATED IMPACTS

Alternative 3 would affect the Green River below the mouth of the White River by reducing the flow by 97 cfs under most conditions. During some dry years, additional water would be depleted from the White River, further depleting the Green. As indicated for the White River Dam Project (Alternative 1), a reduction in flows in the Green River could cause serious changes in the fish fauna. However, a greater reduction in flow than that proposed for this project would be required to cause this change. Therefore, the major impact would be cumulative loss of water from a number of proposed projects. Cumulative impacts are discussed in a later section.

MITIGATION

None.

UNAVOIDABLE ADVERSE IMPACTS

The Hells Hole Canyon Project would not adversely impact the aquatic ecosystem of the Green River by itself. However, the cumulative loss of 70,000 acre-feet of water from this project and from a number of other proposed projects could cause the aquatic ecosystem of the Green River to change significantly.

Threatened, Endangered, and Sensitive Fish Species in the Green River

ANTICIPATED IMPACTS

The effect on Colorado squawfish and other endangered fishes would be similar to that discussed for the White River Dam Project. The major impact would be the cumulative loss of flow.

MITIGATION

The depletion in the Green River caused by the Hell's Hole Canyon Project could be mitigated by an additional release of 97 cfs from Flaming Gorge Dam. Daily and monthly flows from Flaming Gorge during its period of existence have been extremely erratic, with a normal minimum of 800 cfs and a maximum of 4,400 cfs. Since the major concern with aquatic fauna, especially the endangered fishes, is the loss or lowering of present flow levels, it would be desirable that the 97 cfs be added to the normal low flow. This would require the WPRS to release 900 cfs as a minimum, allowing 3 cfs for evaporation and bank losses. Such a process would assure that depletion from the White River during normal years would not reduce the flow below that anticipated without the project and that some of the high releases from the dam during part of the year would be lower than 4,400 cfs. This procedure would not provide more water to the Green River system, rather it would regulate releases to provide for adequate flows for the rare fish. During low flow years, the additional releases from Flaming Gorge Dam would not totally cover the depletions from this project when Hell's Hole Canyon Reservoir is being filled.

UNAVOIDABLE ADVERSE IMPACTS

Although the above mitigation could lessen impacts in the Green River, the cumulative loss of flow in the Green River by this project and other proposed water developments in the Green River system could reduce flows sufficiently to jeopardize the continued existence of the bonytail chub and Colorado squawfish, and perhaps the humpback chub and razorback sucker.

Recreation

WATER-ORIENTED ACTIVITIES

ANTICIPATED IMPACTS

The loss of 97 cfs from the White River is not expected to affect canoeing or fishing on the river in normal years. The depletion during drought years could reduce the canoeing potential, but since actual use is small, the impact would be small.

MITIGATION

None.

UNAVOIDABLE ADVERSE IMPACTS

None.

LAND ORIENTED: HUNTING

ANTICIPATED IMPACTS

The dam could reduce deer hunting in the canyon. The number of hunter days in this area is not known but probably is low, less than 20 hunter days. Deer hunting could also be benefited a small amount if adult deer use the reservoir for water and therefore congregate in this area in the fall. This would offset the small hunting loss indicated above.

The reservoir would increase the opportunities for waterfowl hunting over that which presently exists in the proposed area. The amount of increase would be small and depend on the frequency of fluctuations in the reservoir, as discussed in the Terrestrial Wildlife section of this alternative.

MITIGATION

None.

UNAVOIDABLE ADVERSE IMPACTS

None.

Land Uses, Plans, and Controls

DOMESTIC LIVESTOCK GRAZING

ANTICIPATED IMPACTS

There is currently one grazing allotment in Hell's Hole Canyon (the Hell's Hole Allotment). The proposed dam would affect only a small portion of this allotment, resulting in the loss of approximately 22 AUMs, or use by approximately 28 sheep from January through April. About 40 percent of the allotment affected would be BLM-administered land, the other 60 percent would be private land. Therefore, grazing for about 11 and 17 sheep would be lost from public and private lands, respectively.

MITIGATION

The private land owners would be compensated for the loss of grazing of 17 sheep.

UNAVOIDABLE ADVERSE IMPACTS

Grazing for 11 sheep for 4 months each year on public lands would be lost.

WILDERNESS

ANTICIPATED IMPACTS

There would be no adverse effect upon the wilderness resource since the Hell's Hole area has been rejected for wilderness designation.

MITIGATION

None.

UNAVOIDABLE ADVERSE IMPACTS

None.

WILD HORSES

ANTICIPATED IMPACTS

The dam would have no effect on the wild horses of the area since they inhabit the bench areas and are at most infrequent users of Hell's Hole Canyon.

MITIGATION

None.

UNAVOIDABLE ADVERSE IMPACTS

None.

LAND USE PLANS: BLM

ANTICIPATED IMPACTS

This alternative would have no known impact upon BLM plans.

MITIGATION

None.

UNAVOIDABLE ADVERSE IMPACTS

None.

Visual Resources

ANTICIPATED IMPACTS

No formal visual resource study has been made in the Hell's Hole Canyon area. Therefore, no Visual Resource Management Classes have been determined.

Construction of the Hell's Hole Dam Project would reduce the general visual character of the project area, but since this area is not highly visible, the effects of the project would be very limited. The greatest visual effects would be in the areas where materials necessary for the construction of the dam and road would be removed. Dam construction would also have visual effects from fugitive dust for 2 years.

MITIGATION

Revegetation of the disturbed sites would mitigate much of the reduction in visual quality. Dust would be controlled to a great degree by frequent watering.

UNAVOIDABLE ADVERSE IMPACTS

Land disturbances would remain for the period until revegetation became fully established (approximately 15 years).

Cultural Resources

ANTICIPATED IMPACTS

As a result of a reconnaissance survey, it was determined that there are no known cultural sites in Hell's Hole Canyon, although there is the possibility of some prehistoric lithic scatters. No historic sites occur within the boundaries of this alternative. Therefore, the effects of this alternative upon the cultural resources would be very limited or nonexistent.

MITIGATION

Cultural resources which may be encountered during construction would be recorded and data and artifacts recovered according to a site-specific cultural resource recovery plan.

UNAVOIDABLE ADVERSE IMPACTS

A small but unquantifiable number of cultural sites important to science and education could be lost.

Human Resources

ANTICIPATED IMPACTS

Construction of Hell's Hole Canyon Dam would require from 20 to 60 workers the initial year, and 20 to 40 workers the second year. This means the population of Vernal could increase by up to 111 individuals (Table 4-8), who would require a maximum of 35 housing units. These impacts would be relatively small compared to current growth rates in the area, and are near 1 percent of the present sit-

TABLE 4-8

Employment and Population Effects of Hell's Hole Dam Alternative

	First 2 Years		Second 2 Years		
	High	Low	High	Low	Permanent
Total Employment	60	20	40	20	3
Nonlocal Workers	42	14	28	14	2
Indirect Employment	11	4	7	4	1
Nonlocal Indirect Employment	5	2	3	2	0
Nonlocal Population					
Single	22	7	15	7	1
Household	89	30	59	30	4
Total	111	37	74	37	5

TABLE 4-9

Housing Demands From Hell's Hole Alternative

	First 2 Years		Second 2 Years		
	High	Low	High	Low	Permanent
Construction Demand					
Single Family	11	5	7	5	3
Apartment	3	1	2	1	0
Mobile Home	14	7	10	7	0
Other	3	2	2	2	0
Total	31	15	21	15	3
Indirect Demand					
Single Family	2	1	1	1	1
Apartment	1	0	0	0	0
Mobile Home	1	1	1	1	0
Other	0	0	0	0	0
Total	4	2	2	2	1
Total Housing Demand					
Single Family	13	6	8	6	4
Apartment	4	1	2	1	0
Mobile Home	15	8	11	8	0
Other	3	2	2	2	0
Total	35	17	23	17	4

uation. The same assumptions described in the Human Resources section for the White River Dam Project were used in this analysis and approximately the same socioeconomic impacts would occur.

MITIGATION

None.

UNAVOIDABLE ADVERSE IMPACTS

None.

ALTERNATIVE 4: PUMPING FROM THE GREEN RIVER

Minerals

ANTICIPATED IMPACTS

There are 40 oil and gas leases that would be crossed by the proposed Green River Pipeline, but no unpatented mining claims would be crossed. The impact to the leases would be minimal and exploration or extraction would not be affected, except for a short time during construction when access could be blocked for a few days.

MITIGATION

None.

UNAVOIDABLE ADVERSE IMPACTS

None.

Paleontology

ANTICIPATED IMPACTS

Direct impact from construction of the pump stations on up to 45 acres (18 ha) would be small because little excavation would occur. The greatest impact would result on 380 acres (154 ha) from the pipeline construction, which includes considerable excavation. A number of important fossils could be destroyed during construction. An important fossil floral locality in the corridor was recently found by Miller and Webb (1980). Increased collecting and removal of known fossils in the region would likely result from increased numbers of people associated with the proposed project. Such activity is impossible to quantify but scientifically important fossils including floral remains would be removed from location without proper documentation of information. Scientific and educational values would be lost.

MITIGATION

The applicant would obtain the services of a qualified paleontologist, approved by the appropriate Federal official. The paleontologist would conduct an intensive survey of all areas to be disturbed which have high potential for paleontological resources. The paleontologist would be available, as needed, during surface disturbance. If the paleontologist determined that paleontological values would be lost, construction would be halted until appropriate records or salvage action could be taken.

UNAVOIDABLE ADVERSE IMPACTS

Even with the suggested mitigation, some unavoidable loss of fossils potentially important to science could occur in 380 acres (154 ha). It is unlikely any such loss would be of great significance to the human environment as a whole.

Soils

ANTICIPATED IMPACTS

Erosion during and after construction of the pipeline on 380 acres (154 ha), primarily due to vegetation and soil removal on steep slopes, would be the major problem. Over 75 percent of the pipeline route is fairly level, while there are two very steep areas composed of bedrock with little or no soil. The removal of top soil from the trench area could hamper revegetation efforts following construction. Also, spoil (excess excavated material) is expected, as not all would be replaceable around the pipe.

MITIGATION

The primary mitigation technique would be that described for the White River Dam Project: a two-step revegetation program of disturbed areas. During construction of the pipeline trench, the topsoil would be moved to the side, bladed back after the trench is filled, and then revegetated according

to the revegetation program. This would assure that the best soil is on top for revegetation. The trench would be backfilled with spoil when it met the necessary engineering requirement. The fill would be slightly mounded over the trench to allow for settling. Excess spoil materials would be used for pump station pads if they met the geotechnical criteria. Extra spoil materials would be placed in approved waste sites, shaped to follow the existing natural contours, and revegetated with native plants. Blasting for trench excavation would be done according to authorized techniques, avoiding damage to other facilities. Erosion on slopes over 4 percent in grade would be minimized by construction of waterbars where vegetation had been disturbed.

UNAVOIDABLE ADVERSE IMPACTS

An unquantifiable amount of erosion would occur during construction on 380 acres (154 ha) but its magnitude would be small.

Water Resources

ANTICIPATED IMPACTS

The construction of the Green River Pipeline would not affect groundwater, floodplains, or wetlands. Development of this alternative is expected to produce no significant impacts upon water resource components other than water depletions and downstream water quality in the Green River.

As indicated in Tables 4-2 and 4-3, this alternative would deplete no water from the White River and a continuous amount of 97 cfs (70,000 acre-feet) from the Green River under both "normal" and "worst case" conditions. Water storage for this alternative would be Flaming Gorge Dam.

Depletions at the level indicated in Table 4-2 from the Green River would cause an estimated increase of 3.4 mg/l in Colorado River salinity at Imperial Dam, California. Annual cost of salinity increases are estimated to be $430,000 per mg/l increase at Imperial Dam (Clinton 1980).

MITIGATION

None.

UNAVOIDABLE ADVERSE IMPACTS

The Green River would be depleted by 70,000 acre-feet of water per year. Salinity at Imperial Dam, California, would increase by 3.4 mg/l. The salinity increase would create an annual loss of $430,000 per mg/l.

Vegetation

ANTICIPATED IMPACTS

Construction and operation of the project components required to pump water from the Green River to the White River would disturb up to 15 acres (6 ha) of riparian vegetation along the Green River and approximately 410 acres (166 ha) of sagebrush-greasewood, shadscale, and juniper vegetation along the proposed water pipeline route. Of this land, only 94 acres (38 ha) including up to 15 acres (6 ha) of riparian would be occupied (Table 4-1). Due to the low productivity of the upland vegetation (see Chapter 3, Vegetation section) and the small amount of riparian vegetation, the impact of this alternative on vegetation would be minor.

MITIGATION

Areas disturbed by the construction of the water pipeline, pumping facilities, access roads, and power lines would be revegetated in the same manner as described for disturbed areas in the White River Dam Alternative. In addition, travel would be restricted to the right-of-way or established roads and trails; equipment activities would be allowed only within the right-of-way and authorized stub roads; and scalping of vegetation would be minimized.

UNAVOIDABLE ADVERSE IMPACTS

Up to 15 acres (6 ha) of riparian vegetation and up to 79 acres (32 ha) of upland vegetation would be occupied by the three pumping stations and an access road following pipeline construction. Disturbed areas could require approximately 15 years for native vegetation to become re-established.

THREATENED AND ENDANGERED PLANT SPECIES

ANTICIPATED IMPACTS

Populations of the Uinta Basin hookless cactus could be removed along the pipeline route. Since the major populations of this species occur elsewhere, it is doubtful this action would jeopardize the continued existence of the species. The formal USFWS Biological Opinion on this project has not been released but will be in the Final EIS.

MITIGATION

None.

UNAVOIDABLE ADVERSE IMPACTS

An unquantifiable number of Uinta Basin hookless cactus could be destroyed, but the loss would not jeopardize their continued existence.

Terrestrial Wildlife

ANTICIPATED IMPACTS

Alternative 4 would disturb up to 15 acres (6 ha) of riparian habitat on the Green River and about 410 acres (152 ha) of upland habitat along the pipeline route. Densities of small mammals and birds in these upland areas along the pipeline route are low (Smith 1979), so impacts would be insignificant. There would be short-term impacts to pronghorn antelope during construction, due to restricted access and disturbance to feeding and fawning grounds. Following construction and revegetation, no impacts to antelope are expected.

MITIGATION

Pronghorn fawning grounds would be protected by restricting construction activities from April through June in these important wildlife habitat areas.

UNAVOIDABLE ADVERSE IMPACTS

None.

Aquatic Wildlife

ANTICIPATED IMPACTS

The only impact to the aquatic flora and fauna, including endangered species, involves a 97-cfs reduction in flow in the Green River below Walker Hollow. Impacts of such a flow depletion were discussed for the White River Dam and Hell's Hole Dam Alternatives. The major impact would be the adverse effect of flow reduction, especially from a cumulative standpoint, on bonytail chub and Colorado squawfish, and perhaps humpback chub and razorback sucker.

MITIGATION

Mitigation would be the same as developed for the Hell's Hole Dam (Alternative 3), an increase in the minimun flow release at Flaming Gorge Dam.

UNAVOIDABLE ADVERSE IMPACTS

Alternative 4 would not adversely impact the aquatic ecosystem of the Green River by itself. Although releases from Flaming Gorge would moderate the impact, the cumulative loss of flow in the Green River between this project and other proposed water developments in the Green River system could reduce flows sufficiently to jeopardize the continued existence of the bonytail chub and Colorado squawfish, and perhaps the humpback chub and razorback sucker.

Recreation

ANTICIPATED IMPACTS

The pipeline from the Green River would result in little or no effect to the recreation resources of the project area. The opportunities for ORV use would be affected during the actual construction phase of the project when there would be some obstructions, open trenches, etc. These could easily be circumvented. Some very limited effects on pronghorn antelope hunting could also occur during construction.

MITIGATION

None.

UNAVOIDABLE ADVERSE IMPACTS

None.

Visual Resources

ANTICIPATED IMPACTS

The current Class C scenic quality rating (lack of interesting landforms and existing visible intrusions) would not be violated along the vast majority of the pipeline route. The pump station and pipeline at the Green River would not meet the current B classification. The trench during construction and the roadway along the right-of-way would affect the scenic quality of the majority of the 28 miles (44.8 km) traversed by the pipeline. Once the trench was filled in, much of the visual intrusion would be reduced.

The portion of the pipeline adjacent to the White River would traverse a 2-mile (3.2-km) section of Class A scenic quality. The steep banks, flowing water of the river, and wildlife in the area have been cited as the primary reasons for Class A status. The pipeline here may not meet the Class A criteria for a small area. The resulting road parallel to the pipeline would cause no great visual effect since there are currently roads in the vicinity.

MITIGATION

Sites adjacent to the Green and White Rivers would be concealed and revegetated, and pumping stations along the route would be constructed in harmony with the landscape (form, color, texture, nonspecular).

UNAVOIDABLE ADVERSE IMPACTS

None.

Land Uses, Plans, and Controls

DOMESTIC LIVESTOCK GRAZING

ANTICIPATED IMPACTS

Forage from 380 acres (152 ha) would be temporarily lost for up to 15 years from grazing lands. These rangelands fall in four allotments. Three pump station sites of up to 15 acres (6 ha) each would be permanently lost to grazing. This loss would be of limited effect since there are approximately 154,000 acres (61,600 ha) in the allotments through which the pipeline would be placed.

MITIGATION

Revegetation of the pipeline trench as indicated in the Vegetation section of this alternative would eventually mitigate the loss of vegetation after construction.

UNAVOIDABLE ADVERSE IMPACTS

None.

Wilderness

ANTICIPATED IMPACTS

There would be no adverse effects on wilderness since none of the route of the proposed pipeline is being considered for inclusion in the wilderness system.

MITIGATION

None.

UNAVOIDABLE ADVERSE IMPACTS

None.

LAND USE PLANS

ANTICIPATED IMPACTS

This alternative would have some impact upon the BLM Bonanza MFP. This plan calls for all pipelines and transmission lines to be placed in existing utility corridors. Since this pipeline would not be along an existing corridor, Alternative 4 would be in conflict with the plan. This alternative would not be in conflict with county or regional plans.

MITIGATION

None.

UNAVOIDABLE ADVERSE IMPACTS

The BLM Bonanza MFP objectives would not be met, in that the pipeline route would not follow existing utility corridors.

Cultural Resources

ANTICIPATED IMPACTS

There are two known cultural sites along the pipeline route. Since the entire pipeline route has not been investigated, unknown sites could be encountered. Cultural sites could be disturbed by pipeline construction.

MITIGATION

The entire pipeline route would be surveyed for additional cultural sites. Known cultural sites would be avoided. Where sites are encountered during construction, artifacts would be removed by a qualified archaeologist in conjunction with a site-specific data recovery plan.

UNAVOIDABLE ADVERSE IMPACTS

A small but unquantifiable number of educational and scientific cultural sites could be lost even with the suggested mitigation.

Human Resources

ANTICIPATED IMPACTS

The Green River Pipeline Alternative would have a larger employment and population impact than the White River Dam. Between 80 and 100 construction jobs would be created for 2 years. Table 4-10 indicates employment and population impact projections. Due to the specialized nature of pipeline construction, 90 percent of the work force was assumed to be nonlocal. Other assumptions used were the same as discussed for the White River Dam Alternative. Operation of the pipeline was assumed to require 3 employees, the same number of permanent jobs as other alternatives.

Population was projected to increase by about 188 to 266 persons during construction, which is about a 1-percent increase over existing population. Housing demand would increase up to a total of 75 units (Table 4-11). Therefore, for this alternative, socioeconomic impacts would be slightly greater than, and similar to, those described for Alternative 1.

MITIGATION

None.

UNAVOIDABLE ADVERSE IMPACTS

None.

ALTERNATIVE 5: PUMPING FROM THE WHITE RIVER AND AUGMENTING FROM THE GREEN RIVER

ANTICIPATED IMPACTS

Impacts of this alternative would be the same as indicated for portions of Alternatives 3 and 4; therefore, they will not be reiterated here.

Impacts to minerals, paleontology, soils, terrestrial wildlife, recreation, visual resources, and cultural resources would be of the same magnitude as those for the pipeline in Alternative 4. The pipeline in Alternative 5 would be smaller, but contains more pump stations (7) than Alternative 4 (3 stations). The route would be exactly the same; therefore, the major difference involves loss of upland vegetation associated with pump stations: up to 30 acres (12 ha) for Alternative 4 and 90 acres (36 ha) for Alternative 5. Since this occurs in the relatively unproductive upland areas, no substantive differences in impacts would be expected.

Impacts to water resources and aquatic wildlife in the White and Green Rivers would be identical to those discussed for Alternative 3. No significant impacts would be associated with the infrequent pumping from the Green River.

Mitigation and unavoidable adverse impacts would correspond to those indicated in Alternatives 3 and 4.

TABLE 4-10

Employment and Population Impacts of the Green River Pumping Alternative

	First 2 Years High	Low	Permanent
Total Employment	100	80	3
Nonlocal Workers	90	72	2
Indirect Employment	23	18	1
Nonlocal Indirect Employment	10	9	0
Nonlocal Population			
Single	47	38	
Household	219	150	
Total	266	188	

TABLE 4-11

Housing Demands for Green River Pipeline Alternative

	First 2 Years High	Low	Permanent
Construction Demand			
Single Family	23	18	3
Apartment	6	5	0
Mobile Home	31	25	0
Other	8	6	0
Total	68	54	3
Indirect Demand			
Single Family	4	3	1
Apartment	1	1	0
Mobile Home	2	2	0
Other	0	0	0
Total	7	6	1
Total Housing Demand			
Single Family	27	21	4
Apartment	7	6	0
Mobile Home	33	27	0
Other	8	6	0
Total	75	60	4

ENERGY ANALYSIS OF THE WHITE RIVER DAM ALTERNATIVES

An energy accounting study was completed on the White River Dam and its three possible alternatives to evaluate their energy requirements (see Appendix 8).

Method Used

First, the items used in each project were identified. Second, energy per physical unit conversions, e.g., Btu/cubic yard, were obtained. Third, if energy per physical unit conversions were not available, energy per dollar conversions were employed. Finally, the total project energy for each alternative was found by adding up energy requirements for each component.

Source of Conversions

The majority of the energy per dollar conversions were those developed by the Energy Research Institute and listed in Bullard et al. 1976. These conversions generally proved to be the best available. However, for the earthwork and cement, Bell's (1977) Btu/cy (cubic yard) figures were used because they involve no energy to dollars inaccuracies. In addition, Hannon's (1978) and Gillard's (1975) conversions were used for steel rebar and general energy per dollar respectively.

Results

As shown in Table 4-12, the low energy alternatives for construction would be the White River Dam and Alternative 3. Alternative 4 is the most energy intensive, requiring the most energy for both construction and operation, while Alternative 5 is the second most energy intensive.

The most striking result of the study is that the electricity required to run the pumping stations of Alternative 4 would be of the same order of magnitude, e.g., $4.85X10^{11}$, as for the entire White River Dam Alternative energy requirement. Assuming a coal-fired electrical generating system operating at 33-percent efficiency is to supply the electricity, then the electric power requirement would be of one order of magnitude higher than the White River Dam Project, i.e., approximately $1.5X10^{12}$ Btu.

While the above analysis focused on energy required for construction activities and pumping, it is noted that only the White River Dam, with the proposed hydroelectric power plant, would be a direct energy producer. It is expected that up to $9.9X10^{10}$ Btu would be generated each year by the power plant.

SUMMARY OF UNAVOIDABLE ADVERSE IMPACTS, IRREVERSIBLE/ IRRETRIEVABLE COMMITMENTS OF RESOURCES, AND THE RELATIONSHIP OF SHORT-TERM USE OF THE ENVIRONMENT TO MAINTENANCE AND ENHANCEMENT OF LONG-TERM PRODUCTIVITY

Table 4-13 summarizes and compares the unavoidable adverse impacts discussed in the preceeding section. The comparison is by alternative and environmental element. This table does not list impacts of very low significance or of very short duration, or those that are readily mitigated.

Table 4-13 also indicates whether the adverse impact is irreversible or irretrievable. Actions committing future generations to continue a similar course are considered irreversible. Irretrievable is defined as irrecoverable, not retrievable; once used, not replaceable.

The relationship between short-term uses of the environment to maintenance and enhancement of long-term productivity is briefly discussed for each alternative and resource and completes the table. Short term is generally used as the life of the project. The life of Alternative 1, the White River Dam, is difficult to assess. It is 52 years if the time period the project can deliver 70,000 acre-feet of water is used. It is 82 years if the time period for the reservoir to fill completely with sediment is used. Potential future depletions of the White River in Colorado could extend the life of the White River Dam by reducing sediment loads. Long term is the period beyond the project's predicted life.

TABLE 4-12

Summary of Energy Analysis (in Btu's)

	Alternative 1 White River Dam	Alternative 2 No Action	Alternative 3 Hell's Hole Dam	Alternative 4 Green River Pumping	Alternative 5 Green River Supplement Pumping
Construction for 2-Year Period	7.72×10^{11}	0	7.64×10^{11}	4.1×10^{12}	2.39×10^{12}
Operation for 80 or more years more years	9.9×10^{9} produced each year	0	1.26×10^{10} Btu/cy used each year	4.85×10^{11} Btu/cy used each year	1.18×10^{11} Btu/cy used each year

3,413 Btu/KWH.

$$\frac{\$55,600}{\$0.015/\text{KWH}} = 3.71 \times 10^{6} \text{ KWH} = 1.26 \times 10^{10} \text{ Btu}$$

$\$520,600 \div \$0.015/\text{KWH} = 3.47 \times 10^{10}$ KWH $= 1.18 \times 10^{11}$ Btu.

TABLE 4-13

Summary of Impacts by Alternatives

Environmental Element (Resource)	Unavoidable Adverse Impacts	Commitment of Resource Irreversible	Commitment of Resource Irretrievable	Relationship of Short-Term Use of Environment to Long-Term Productivity
ALTERNATIVE 1 - WHITE RIVER DAM				
Minerals	Unquantifiable amounts of oil shale and other minerals would not be available for extraction during the life of the project on the 1,860 acres (753 ha) inundated by the reservoir.	No	Project life	After the reservoir basin filled in with sand and silt, the resources could be recovered; hence, no loss would occur in the long term.
Paleontology	Some fossils potentially important to science could be lost on 3,600 acres (1,457 ha).	Yes	Yes	Once lost, the fossils could not be replaced or recovered.
Soils	An unquantifiable amount of soil would be lost on 1,787 acres (723 ha) due to erosion and removal of construction material at dam site.	No	Yes	The duration of the loss would extend through a few years or several decades, depending on the severity of the disturbance.
Water Resources	A 67,000 acre-foot yearly depletion in flows of the White and Green Rivers.	No	Yes	The water depleted would not be available in the short term, but would be available in the long term.
	A 3.4 mg/l increase in salinity at Imperial Dam would occur.	No	Project Life	Water quality would be restored when the depletion is no longer needed.
	The channel of the White River below the dam would be armored as fine sediments would be scoured out of the bed.	Yes	Yes	The channel would remain armored long after the reservoir was filled in with silt and sand.
	Below the dam, water temperature would decrease and water clarity would increase. Sedimentation of the Reservoir would be unavoidable and would impact the long-range future utility of reservoir storage.	No	Project Life	Water temperature would not return to normal in the reservoir basin or below in the White River.
Floodplains	About 995 acres (403 ha) of riparian floodplain would be inundated. Another 4,575 acres (1,852 ha) below the dam would be affected by decreased flows and armoring, causing a decrease in total riparian acreage.	No	Yes	The floodplain would reestablish after the reservoir is filled with sand and silt or is no longer needed.
Vegetation				
General	About 995 acres (403 ha) of riparian and 557 acres (225 ha) of upland vegetation would be inundated by the reservoir. An additional 1,777 acres (719 ha) of upland vegetation would be temporarily disturbed and an unquantifiable amount of downstream riparian-floodplain vegetation would be lost or modified on 4,575 acres (1,852 ha).	No	Project Life	It is not likely the disturbed areas would be restored to their native condition, but productivity would be restored when the reservoir is no longer needed.
Threatened, Endangered, and Sensitive Species	One population of a potentially new species *Penstemon* would be inundated.			

TABLE 4-13 (continued)

Environmental Element (Resource)	Unavoidable Adverse Impacts	Commitment of Resource: Irreversible	Commitment of Resource: Irretrievable	Relationship of Short-Term Use of Environment to Long-Term Productivity
Terrestrial Wildlife				
Mammals	The inundation of about 995 acres (403 ha) of riparian habitat would result in the loss of up to: 176 beaver; 25,000 deer mice; 3,200 bushy-tailed woodrats; 26 porcupines; 189 cottontails; and 200 deer. Unquantified additional loss to these species would occur in the riparian area along the White River below the dam. Additional unquantified deer losses would occur in surrounding areas which presently rely on the White River riparian area for fawn production.	No	Yes	Habitat lost for all mammals would not be restored to the present condition, but could be partially restored when the reservoir is no longer needed.
Birds	Loss of about 995 acres (403 ha) of riparian habitat would displace 90 of 126 species of nongame birds. Reduction of raptor population would occur due to loss of prey species (especially during drought conditions. An annual production of 36 Canada geese would be lost from the reservoir basin and an additional small but unquantifiable amount of goose production would be lost from the White River below the dam.	No	Yes	Habitat lost for birds would not be restored to the present condition but could be partly restored when the reservoir is no longer needed.
Threatened, Endangered, and Sensitive Species	None.			
Aquatic Wildlife				
White River				
General	The native aquatic ecosystem would be lost in the 13.5 miles (22 km) of the reservoir and altered in the 50 miles (80 km) below the dam. A partial loss of native fauna would occur in the lower 10-20 miles (16-32 km) of the White River.	No	Yes	The loss of the native system could not be replaced until the reservoir fills in and forms a river again. At that time, habitat would be too altered to support an ecosystem as it is at present.
Threatened, Endangered, and Sensitive Species	Blockage of the White River channel and change in water quality would result in loss of habitat for the Colorado squawfish.	Yes	Yes	Once these species are extinct, they are lost forever.

(continued)

TABLE 4-13 (continued)

Environmental Element (Resource)	Unavoidable Adverse Impacts	Commitment of Resource Irreversible	Commitment of Resource Irretrievable	Relationship of Short-Term Use of Environment to Long-Term Productivity
Green River				
General	The Hell's Hole Canyon Project would not adversely impact the aquatic ecosystem of the Green River by itself. However, the cumulative loss of 70,000 acre-feet of water from this project and from a number of other proposed projects could cause the aquatic ecosystems of the Green River to change significantly.	No	Yes	The loss of the native system could not be replaced once it was lost.
Threatened, Endangered, and Sensitive Species	The cumulative loss of flow in the Green River by this project and other proposed water developments in the Green River system could reduce flows sufficiently to jeopardize the continued existence of the bonytail chub and Colorado squawfish, and perhaps the humpback chub and razorback sucker.	Yes	Yes	Once these species are extinct, they are lost forever.
Recreation	None.			
Visual Resources	Land disturbance would remain for the period until revegetation became fully established, for approximately 15 years.			
Land Use	Grazing for 11 sheep for 4 months each year on public lands would be lost.	No	Yes	The grazing would be lost until the reservoir revegetates.
Cultural Resources	A small but unquantifiable number of cultural sites important to science and education could be lost.	Yes	No	Once the sites are disturbed, their information cannot be regained.
Human Resources	None.			

TABLE 4-13 (continued)

Environmental Element (Resource)	Unavoidable Adverse Impacts	Commitment of Resource Irreversible	Commitment of Resource Irretrievable	Relationship of Short-Term Use of Environment to Long-Term Productivity
ALTERNATIVE 3 - PUMPING FROM WHITE RIVER - SUPPLEMENT WITH HELL'S HOLE CANYON DAM WATER				
Minerals	Some loss of oil shale recovery would occur on about 295 acres (119 ha).	No	Project Life	The oil shale could be recovered when the reservoir is no longer used.
Paleontology	An unquantifiable number of important fossils could be destroyed in 315 acres (127 ha).	Yes	Yes	Once lost, the fossils could not be replaced.
Soils	A small amount of soil would be lost by erosion from disturbed areas.	No	Yes	The duration of the loss would extend through a few years or several decades, depending on the severity of the disturbance.
Water Resources	A 70,000 acre-foot yearly depletion in flows of the White and Green Rivers.	No	No	The water depleted would not be available in the short term, but would be available in the long term.
	A 3.4 mg/l increase in salinity at Imperial Dam would occur.	No	Yes	Water quality would be restored when the depletion is no longer needed.
Vegetation				
General	Loss of 0.5 acres (0.2 ha) of riparian and 339 acres (132 ha) of upland vegetation would occur.			
Threatened, Endangered, and Sensitive Species	None.			
Terrestrial Wildlife				
Mammals	None.			
Birds	None.			
Threatened, Endangered, and Sensitive Species	None.			
Aquatic Wildlife				
White River				
General	The cumulative loss of 70,000 acre-feet of water from this project and additional depletions from other future projects on the White River could cause a loss of the native ecosystem in the White River.	No	Yes	The native ecosystem could be re-established if the water was returned to the river.
Threatened, Endangered, and Sensitive Species	The Hell's Hole Canyon Project would not adversely impact endangered fish utilization of the White River by itself, However, the cumulative loss of flows in the White River from this project and other future projects could eliminate the White River as squawfish habitat due to insufficient flow.	Yes	Yes	Once these species are extinct, they are lost forever.

TABLE 4-13 (continued)

Environmental Element (Resource)	Unavoidable Adverse Impacts	Commitment of Resource		Relationship of Short-Term Use of Environment to Long-Term Productivity
		Irreversible	Irretrievable	
Green River				
General	The proposed White River Dam would not adversely affect aquatic habitat of the Green River; however, the cumulative loss of 70,000 acre-feet of water from this project and from a number of other proposed projects could cause the aquatic ecosystems of the Green River to change significantly.	No	Yes	Once the aquatic ecosystem is lost, it would never be replaced exactly.
Threatened, Endangered, and Sensitive Species	The cumulative loss of flow in the Green River by this project and other proposed water developments in the Green River system could reduce flows sufficiently to jeopardize the continued existence of the bonytail chub and Colorado squawfish and perhaps the humpback chub and razorback sucker.	Yes	Yes	Once these species are extinct, they are lost forever.
Recreation	13.5 miles (22 km) of canoeing stream would be lost.	No	Yes	The loss of canoeing stream cannot be replaced.
	Up to 936 hunter days per year for deer would be lost in the State of Utah, along with a small but unquantifiable loss in hunter days for geese.	No	Yes	The deer population would reestablish after the reservoir area revegetates.
Visual Resources	The current BLM Class II Visual Resource Management Objectives would not be met.	No	Yes	The losses of flowing water, the riparian zone, and abundant wildlife (factors responsible for Class A scenic quality) would be replaced after the reservoir is no longer needed.
Land Use	A loss of forage for 23 cattle grazing 4.5 months on public land would occur. This reduction in livestock production would cause an economic loss to the rancher.	No	Yes	The grazing would be lost until the reservoir revegetates.
	The current BLM Bonanza Management Framework Plan would not be met.	No	No	The Plan may be changed to adapt to this project.
Cultural Resources	Some unquantifiable cultural resources may be destroyed or damaged during construction activities. Increased ease of access and use of the area may increase the potential for vandalism of archaeological sites.	Yes	Yes	Once the sites are disturbed, their information cannot be regained.
Human Resources	None.			

(continued)

TABLE 4-13 (continued)

Environmental Element (Resource)	Unavoidable Adverse Impacts	Commitment of Resource: Irreversible	Commitment of Resource: Irretrievable	Relationship of Short-Term Use of Environment to Long-Term Productivity
ALTERNATIVE 4 - PUMPING FROM THE GREEN RIVER				
Minerals	None.			
Paleontology	An unquantifiable number of fossils important to science could be lost on the 380 acres (154 ha).	Yes	Yes	Once lost, the fossils could not be replaced.
Soils	An unquantifiable amount of soil would be lost by erosion on the 380 acres (154 ha) disturbed.	No	Yes	The duration of the loss would extend through a few years or several decades, depending on the severity of the disturbance.
Water Resources	The Green River would be depleted by 70,000 acre-feet of water per year.	No	No	The water depleted would not be available in the short term but would be available in the long term.
	A 3.4 mg/l increase in salinity at Imperial Oam would occur.	No	Yes	Water quality would be restored when the depletion is no longer needed.
Vegetation				
General	Up to 15 acres of riparian vegetation and up to 79 acres of upland vegetation would be occupied by three pump stations and an access road. Oisturbed areas could require up to 15 years for native vegetation to become reestablished.	No	Yes	It is not likely the occupied areas would be restored to their native condition or productivity.
Threatened, Endangered, and Sensitive Species	A small but unquantifiable number of Uinta Basin hookless cactus may be destroyed; but the loss would not jeopardize their continued existence.	Yes	Yes	Once lost, these populations could not be replaced.
Terrestrial Wildlife				
Mammals	None.			
Birds	None.			
Threatened, Endangered, and Sensitive Species	None.			
Aquatic Wildlife				
White River				
General	None.			
Threatened, Endangered, and Sensitive Species	None.			
Green River				
General	Alternative 4 would not adversely impact the aquatic ecosystem of the the Green River. However, the cumulative loss of 70,000 acre-feet of water from this project and from a number of other proposed projects could cause the aquatic ecosystems of the Green River to change significantly.	No	Yes	Once the aquatic ecosystem is lost, it would never be replaced exactly.

TABLE 4-13 (concluded)

Environmental Element (Resource)	Unavoidable Adverse Impacts	Commitment of Resource: Irreversible	Commitment of Resource: Irretrievable	Relationship of Short-Term Use of Environment to Long-Term Productivity
Threatened, Endangered, and Sensitive Species	The cumulative loss of flow in Green River by this project and and other proposed water developments in the Green River system could reduce flows sufficiently to jeopardize the continued existence of the bonytail chub and Colorado squawfish and perhaps the humpback chub and razorback sucker.	Yes	Yes	Once these species are extinct, they are lost forever.
Recreation	None.			
Visual Resources	None			
Land Use	None.			
	The BLM Bonanza Management Framework Plan would not be met in that the pipeline route would not follow existing utility corridors.	No	No	The Plan may be changed to adapt to this project.
Cultural Resources	An unquantifiable number of educational and scientific cultural sites may be lost even with the suggested mitigation. It is doubtful that any significant sites would be lost.	Yes	Yes	Once the sites are disturbed, their information cannot be regained.
Human Resources	None.			
ALTERNATIVE 5 - PUMP WATER FROM THE WHITE RIVER, SUPPLEMENT WITH WATER FROM GREEN RIVER				
Minerals	None.			
Paleontology	Same as Alternative 4.			
Soils	Same as Alternative 4.			
Water Resources	Same as Alternative 3.			
Vegetation				
General	Same as Alternative 4, except loss of up to 60 acres (36 ha) more of upland vegetation due to pumping stations and access road following pipeline construction.			
Threatened, Endangered, and Sensitive Species	None.			
Terrestrial Wildlife	None.			
Aquatic Wildlife	Same as Alternative 3.			
Recreation	None.			
Visual Resources	None.			
Land Use	None.			
Cultural Resources	Same as Alternative 4.			
Human Resources	None.			

CUMULATIVE IMPACTS

The Uinta Basin in Utah and the adjacent portions of western Colorado are expected to contain a significant portion of the future energy development in the western United States. Coal, oil shale, and tar sands are the major energy reserves. Therefore, rather large increases in consumptive use of water and in present human population characteristics are expected. The White River Dam Project, or one of its alternatives, would add to the cumulative impacts of both water development (depletion) and increased population.

As discussed previously, the White River Dam Project and its alternatives are expected to deplete 70,000 acre-feet of water from the upper Colorado system. Table 4-14 indicates other projected depletions from the various drainages of the system, based primarily upon WPRS (1979) information.

These projected depletions from the system, including the 70,000 acre-feet from this project, total 494,000 acre-feet of water, of which this project contributes 14 percent. Under appropriate economic conditions, oil shale development could be expected to increase considerably and demand substantially more water from the upper Colorado system. The Juniper-Cross Mountain Project, proposed by the Colorado River Water Conservation District and expected to store 1,200,000 acre-feet of water, may ultimately result in additional depletions should it commence operations and support uses beyond hydroelectric power generation. A variety of other potential projects, and hence depletions, have been identified, discussed, and/or proposed on the system, but cannot be quantified or even considered to be probable at this time.

The cumulative impact of depleting large quantities of water from the system can be expected to result in as much as 19 mg/l increases in salinity at Imperial Dam, California, primarily because the depletions would be of relatively high quality relative to downstream water quality. The cumulative impacts of these water depletions upon both irrigation and future water supply would be essentially a matter of the water not being available for such uses in the short term. Although not irreversibly committed, reallocation of the water depleted would be difficult from both economic and institutional aspects.

As indicated in previous sections, a major significant impact of the proposed project would be its effect upon the threatened and endangered fish species of the upper Colorado River system. This impact would be most serious in terms of the cumulative effect of the several developmental projects planned or underway in the system. Individually, certain of the projects may not have a serious effect on the fish populations but, considered cumulatively, would likely significantly impact the species of concern.

Available data indicate the endangered bonytail chub has been seriously impacted, to near extinction, by past water depletions. Present data also indicate the Colorado squawfish, also endangered, had lowered reproductive success in the Green River, the most reproductively successful habitat remaining for this fish, in a recent year of natural drought. This information, and data from the Colorado River, suggest there is a flow level below which Colorado squawfish reproductive success will be lower than at present. The actual flow level where this would occur is not known. Therefore, the cumulative water depletions of the projects presently being developed and proposed for development in the near future could cause the extinction of the bonytail chub and could cause Colorado squawfish to become closer to extinction in the Green River system.

The cumulative effects of the loss of wildlife habitat, especially for game mammals such as deer from energy and water development within the upper Colorado River basin could result in a substantial loss of animals and, in turn, cause the loss of a large number of hunter days. As discussed earlier in this chapter, this loss due to the White River Dam is estimated to be 936 days for deer. If the effects from similar projects were similar, the cumulative impact would be substantial.

The cumulative effects of the loss of grazing resources due to energy and water developments in the upper Colorado basin would be moderate. This cumulative loss would need to be examined from the standpoint of a loss to the range resources of the area and the resulting economic value. The loss of the grazing resource due to the White River Dam would be a small contributor when examined from a cumulative standpoint.

The cumulative effects of energy and water developments within the upper Colorado River basin could reduce the viability of both commercial and private river running on the entire Colorado system. While flows diverted from the White River would themselves have little impact on this activity, the cumulative water reduction could shorten the season and reduce the number of trips through Desolation, Gray, Cataract, and the Grand Canyon.

The White River Dam would, at the high point of construction, employ up to 50 persons. The Green River Pipeline would employ 100 persons. Some of them could immigrate from other places with their families. The net effect would be up to 94 additional persons living in Uintah County, Utah, for the White River Dam Project and 266 additional per-

TABLE 4-14

Potential Depletions From the Upper Colorado River System[a]

Drainage	Project	Acre-feet Depletion
Yampa	Hayden-Craig	20,000
	Cheyenne-Laramie	24,000
Duchesne	Central Utah Project (4 units)	221,000
	Deferred Indian Lands	50,000
White (in Colorado)	Oil Shale Development	78,000
White (in Utah)	Ute Indian Irrigation[b]	31,000
	Total Depletions -	424,000

[a]Best available assumptions to the year 2000.

[b]Based on irrigation of 12,833 acres (5,194 ha).

sons for the Green River Pipeline. These persons would place additional demands on housing, schools, police, fire protection, health care, roads, and other services. At this time, those new persons could be accommodated without much, if any, effect on the community. There is, however, the larger picture of which the White River Dam is only a small portion. That is the cumulative aspect of energy and water development within the Uinta Basin.

As summarized in Table 4-15, a substantial increase in employment is projected for the project vicinity due to energy and water development during the next 15 years. A peak figure of 11,759 is projected for 1991. This figure represents a substantial immigration of workers to the area. In light of these projections, the cumulative effects of water and energy development on human resources and quality of life in eastern Utah and western Colorado will be great, but the portion of that impact attributed to the White River Dam Project is small.

TABLE 4-15

Cumulative Employment Projections, 1981-1995

	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995
Moon Lake PP	227	457	919	1,240	936	833	200	200	200	200	200	200	200	200	200
Deserado Mine	159	390	190	202	677	613	594	594	594	594	594	594	594	594	594
Superior	50	268	458	847	1,329	1,310	920	920	920	920	920	920	920	920	920
Ca	--	550	1,300	2,300	2,500	2,500	2,500	2,500	2,000	2,000	2,000	2,000	2,000	2,000	2,000
Cb	--	2,098	1,774	1,600	1,600	1,600	1,600	1,600	1,600	1,600	1,600	1,600	1,600	1,600	1,600
Paraho	--	350	350	350	350	350	350	350	350	350	350	350	350	350	350
Colowyo	--	220	220	220	220	220	200	220	220	220	220	220	220	220	220
Anschutz	--	180	180	180	180	180	180	180	180	180	180	180	180	180	180
Mid-Continent	--	40	40	40	40	40	40	40	40	40	40	40	40	40	40
Geokinetics	102	137	174	212	248	284	320	358	394	430	430	430	430	430	430
TOSCO	555	1,275	1,165	720	520	520	529	520	520	520	520	520	520	520	520
White River Shale	5	205	305	705	842	400	324	324	2,300	4,500	4,700	3,800	2,300	2,050	2,050
White River Dam[a]	94	94	36	36	5	5	5	5	5	5	5	5	5	5	5
Total	1,398	5,913	7,085	8,626	9,452	9,060	7,778	7,816	9,836	11,564	11,764	10,864	9,364	9,114	9,114

Sources: Uinta Basin Association of Governments; Draft Environmental Statement, Proposed Superior Oil Company Land Exchange and Oil Shale Resource Development, U.S. Department of the Interior, Bureau of Land Management; and Burns and McDonnell.

[a]Projections based on Utah Division of Water Resources data.

LIST OF PREPARERS

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The following individuals (with their project assignment, education, and total years of professional experience) made up BLM's Core Team:

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BIO/WEST, INC.

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SCOTT GREENWOOD: Cover Drawings and Simulations. 10 years.

JOAN K SHAW: Editor. M.A. English. 10 years.

NANCY HUBBARD: Typist. 15 years.

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AGENCIES, ORGANIZATIONS, AND PERSONS TO WHOM COPIES OF THE DRAFT EIS WILL BE SENT

Comments have been requested from many agencies, organizations, and individuals including the following:

Federal Agencies

Department of Agriculture

- Agricultural Stabilization and Conservation Service
- Forest Service
- Soil Conservation Service

Department of the Interior

- Geological Survey
- Fish and Wildlife Service
- Bureau of Indian Affairs
- Bureau of Mines
- Water and Power Resources Service
- Heritage Conservation and Recreation Service
- National Park Service
- Office of the Solicitor
- Department of Commerce
- Advisory Council on Historic Preservation
- Environmental Protection Agency

State Agencies

State of Utah

- Clearing House
- Department of Natural Resources
- Division of Water Resources
- Division of Wildlife Resources
- Division of Lands
- Division of Oil, Gas, and Mining

University of Utah

Utah State University

State of Colorado

- Clearing House

Local Agencies

- Uintah County Commissioners
- Uintah Basin Energy Planning Council
- Uintah Water Conservancy District
- Ute Indian Tribe

Nongovernment Organizations

- Audubon Society
- Brigham Young University
- Common Cause
- Council on Utah Resources
- Defenders of the Outdoor Heritage
- Defenders of Wildlife
- Friends of the Earth
- League of Women Voters
- National Council of Public Land Users
- National Parks and Recreation Association
- National Stock Grower's Association
- National Wildlife Federation
- Natural Resources Defense Council
- Pro-Utah Inc.
- Public Lands Council
- Save Our Canyons Committee
- Sierra Club
- Society for Range Management
- The Wilderness Society
- The Wildlife Society
- Utah Cattlemen's Association
- Utah Council, Trout Unlimited

Utah Farm Bureau

Utah Sportsmen Association

Utah Archaeological Society

Utah Gem and Mineral Society

Utah Water Pollution Control Association

Utah Wilderness Association

Utah Wildlife and Outdoor Recreation Federation

Utah Wool Grower's Association

Wild and Scenic Rivers

Congressional

Utah Delegation

Interested Individuals

Copies of this Draft EIS will be available for public inspection at the BLM offices listed below:

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Vernal District Office
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APPENDIX 1

Federal and State Authorizing Actions
Alternative 1 - White River Dam

Project Feature	Magnitude	Authorizing Action	Authority
		Federal Authorizing Actions	
Department of the Interior Bureau of Land Management			
Earth Dam, Ancillary Facilities, and Reservoir	4,413.29 ac.	a. Grant right-of-way.	a. Title V of Federal Land Policy and Management Act of 1976 (90 Stat. 2776 et. seq.).
		or b. Sell public lands to State of Utah.	b. Title II of Federal Land Policy Act of 1976 (90 Stat. 2750).
		or c. State of Utah could select public lands.	c. State Indemnity Grants 43 CFR 2621.0-3.
		or d. Exchange public lands for State owned lands.	d. Title II of Federal Land Policy Act of 1976, Sec. 206 43 CFR 2210.
Power Transmission System (Routes)	69 ac.	Grant right-of-way.	Title V of Federal Land Policy and Management Act of 1976 (90 Stat. 2776 et. seq.).
Access Road	40-50 ac.	Grant right-of-way.	Title V of Federal Land Policy and Management Act of 1976 (90 Stat. 2776 et. seq.), Act of August 27, 1958 (72 Stat. 892, Title 23 USF Sec. 107). C
Off-Site Construction Materials (sand, gravel, clay, etc.)	1,315 ac.	a. Issue Temporary Use Permit for field investigations to locate suitable materials for dam construction.	a. Title V of Federal Land Policy and Management Act of 1976, Sec. 302 (90 Stat. 2778).

APPENDIX 1, Alternative 1 (continued)

Project Feature	Magnitude	Authorizing Action	Authority
		b. Issue permit for mineral materials disposal.	b. The Materials Act of July 31, 1947, as amended by the Acts of July 23, 1955 and September 25, 1962 (30 USC 601, 602).
Miscellaneous Uses of Public Lands (storage of equipment, staging areas, other)	10 ac.	Issue Temporary Use Permit.	Title V of Federal Land Policy and Management Act of 1976, Sec. 302 (90 Stat. 2778).
Department of Defense Army Corps of Engineers			
Earth Dam and Ancillary Facilities		Grant 404 Permit for placement of structure and fill in navigable waters.	Federal Clean Water Act of 1977 (33 USC, 1251). Federal Water Pollution Control Act Amendment of 1972.
Federal Energy Regulatory Commission			
Hydroelectric Power Plant and Primary Power Transmission System.		Issue license.	Federal Power Act of 1935 16 USC, Sec. 791(a) et. seq.
Environmental Protection Agency			
		a. Review and comment on EIS.	a. NEPA 1969, Section 309 of Clean Air Act.
		b. Review 404 permit application in conjunction with Army Corps of Engineers.	b. Section 404 of Water Pollution Control Act, as amended in 1972. Section 402 of Clean Water Act and Clean Air Act as amended.
		c. Issue NPDES Permit, if there is water discharged during dam construction.	c. Section 402 of Clean Water Act.

APPENDIX 1, Alternative 1 (continued)

Project Feature	Magnitude	Authorizing Action	Authority
		State of Utah Authorizing Actions	
Utah State Division of Lands			
Power Transmission System (routes)	4 ac.	Grant right-of-way.	Utah Code Annotated 1953, as amended 65-2-1.
Reservoir	672.83 ac.	a. Lease land.	a. Utah Code Annotated 65-1-108.
		or	
		b. Sell land.	b. Utah Code Annotated 65-1-29.
		or	
		c. Grant easement.	c. Utah Code Annotated 65-2-1.
Utah State Division of Water Rights			
Surface Water Sources (White River)	105,000 ac-ft	Approve Water Appropriation Applications filed by proponents of project.	Utah Code Annotated 73-3-1 through 73-3-28.
Earth Dam and Ancillary Facilities		Approve design of dam and ancillary facilities with reference to safety, etc.	Utah Code Annotated 73-5-5, 73-5-6, 73-5-7, 73-5-12.
Utah State Department of Development Services Division of State History			
Project Area	4,413.29 ac.	Issue Clearance Notice Concerning Cultural Resources.	Utah Code Annotated 63-18, 1966 Historic Preservation Act.
		Local Authorizing Action	
Uintah County, Utah			
		None.	

APPENDIX 1 (continued

Alternative 3 - Hell's Hole Canyon Dam

Project Feature	Magnitude	Authorizing Action	Authority
		Federal Authorizing Actions	
Department of the Interior Bureau of Land Management			
Earth Dam, Ancillary Facilities, and Reservoir	260 ac.	a. Grant right-of-way.	a. Title V of Federal Land Policy and Management Act of 1976 (90 Stat. 2776 et. seq.).
		or b. Sell public lands to State of Utah.	b. Title II of Federal Land Policy Act of 1976 (90 Stat. 2750).
		or c. State of Utah could select public lands.	c. State Indemnity Grants 43 CFR 2621.0-3.
		or d. Exchange public lands for State owned lands.	d. Title II of Federal Land Policy Act of 1976, Sec. 206 43 CFR 2210.
Pumping Station and 0.5 Mile Pipeline	a. 3.5 ac.	a. Grant right-of-way.	a. Title V of Federal Land Policy and Management Act of 1976 (90 Stat. 2776 et. seq.).
Power Distribution Line	b. 1.45 mi. (10.5 ac.)	b. Grant right-of-way.	a. Title V of Federal Land Policy and Management Act of 1976 (90 Stat. 2776 et. seq.).
Access Road	c. 0.6 mi. (1.3 ac.)	c. Grant right-of-way.	a. Title V of Federal Land Policy and Management Act of 1976 (90 Stat. 2776 et. seq.).

APPENDIX 1, Alternative 3 (continued)

Project Feature	Magnitude	Authorizing Action	Authority
		State of Utah Authorizing Actions	
Utah State Division of Water Rights			
Surface Water Sources (White River)	70,000 ac-ft[a]	Approve Water Appropriation Application filed by proponents of project.	
Earth Dam and Ancillary Facilities		Approve design of dam and ancillary facilities with reference to safety, etc.	Utah Code Annotated 73-5-5, 73-5-6, 73-5-7, 73-5-12.
Utah State Department of Development Services Division of State History			
Project Area	800 ac.	Issue clearance notice concerning cultural resources.	Utah Code Annotated 63-18, 1966 Historic Preservation Act.
		Local Authorizing Action	
Uintah County, Utah			
		None.	

APPENDIX 1 (continued)

Alternative 4 - Pumping From Green River

Project Feature	Magnitude	Authorizing Action	Authority
		Federal Authorizing Actions	
Department of the Interior Bureau of Land Management			
Pipeline, Pump Stations (3), Power Lines, and Access Road	361 ac.	Grant right-of-way.	Title V of Federal Land Policy and Management Act of 1976 (90 Stat. 2776 et. seq.).
Miscellaneous Uses of Public Lands (Storage of Equipment, Staging Areas, Other)	10 ac.	Issue Temporary Use Permit.	Title V of Federal Land Policy and Management Act of 1976, Sec. 302 (90 Stat. 2778).
Environmental Protection Agency			
		a. Review and comment on EIS.	a. NEPA 1969, Section 309 of Clean Air Act.
		b. Review 404 Permit Application.	
		State of Utah Authorizing Actions	
Utah State Division of Lands			
Pipeline, Pump Stations, Power Transmission Lines, Access Roads	37 ac.	Grant right-of-way.	Utah Code Annotated 1953, as amended 65-2-1.
Utah State Division of Water Rights			
Surface Water Sources (White River)	70,000 ac-fta	Approve Water Appropriation Applications filed by proponents of project.	Utah Code Annotated 737-3-1 through 73-3-28.

APPENDIX 1, Alternative 4 (continued)

Project Feature	Magnitude	Authorizing Action	Authority
Utah State Department of Developmental Services Division of State History			
Project Area	425 ac.	Issue Clearance Notice concerning cultural resources.	Utah Code Annotated 63-18, 1966 Historic Preservation Act.

Local Authorizing Action

Uintah County, Utah

None.

APPENDIX 1 (continued)

Alternative 5 - Pumping From White River and Supplementing With Water Pumped From Green River

Project Feature	Magnitude	Authorizing Action	Authority
	Federal Authorizing Actions		
Department of the Interior Bureau of Land Management			
Pipeline, Pump Station (7), Power Lines, Access Roads	361 ac.	Grant right-of-way.	Title V of Federal Land Policy and Management Act of 1976 (90 Stat. 2776 et. seq.). 43 CFR 2210.
Miscellaneous Uses of Public Lands (Storage of Equipment, Staging Areas, Other)	10 ac.	Issue Temporary Use Permit.	Title V of Federal Land Policy and Management Act of 1976 Sec. 302 (90 Stat. 2778).
	State of Utah Authorizing Actions		
Utah State Division of Lands			
Pipeline, Pump Stations, Power Transmission Lines, Access Roads	67 ac.	Grant right-of-way.	Utah Code Annotated 1953, as amended 65-2-1.
Utah State Division of Water Rights			
Surface Water Sources	70,000 ac-fta	Approve Water Appropriation Applications filed by proponents of project.	Utah Code Annotated 73-3-1 through 73-3-28.
Earth Dam and Ancillary Facilities		Approve design of dam and ancillary facilities with reference to safety, etc.	Utah Code Annotated 73-5-5, 73-5-6, 73-5-7, 73-5-12.

APPENDIX 1, Alternative 5 (concluded)

Project Feature	Magnitude	Authorizing Action	Authority
Utah State Department of Developmental Services Division of State History			
Project Area	485 ac.	Issue Clearance Notice concerning cultural resources.	Utah Code Annotated 63-18, 1966 Historic Preservation Act.
		Local Authorizing Action	
Uintah County, Utah			
		None.	

[a]This amount of water is presently informally committed; however, the State of Utah has applied for 250,000 acre-feet.

APPENDIX 2

English-Metric Conversion Factors

Multiply	By	To Obtain
acres	.40469	hectares (ha)
cubic yards	.7646	cubic meters (m^3)
feet	.3046	meters (m)
inches	2.540	centimeters (cm)
inches	25.40	millimeters (mm)
gallons	3.7854	liters (l)
miles	1.609	kilometers (km)
square miles	2.59	square kilometers (km^2)
1,000 acre-feet/year	1.38	cubic feet/sec (cfs)

Note: To convert Fahrenheit to Centigrade: 5/9 (F°-32)

[illegible]

APPENDIX 3

Background Information on Minimum Flow
Releases Including Ute Indian Water Rights

The BLM along with a consulting firm has prepared this Draft EIS with an understanding that 250 cfs would be the minimum water release through the proposed White River Dam outlet works. It was reasoned that during prolonged periods of extreme drought and associated low flows in the White River water stored in the proposed White River Reservoir could potentially be depleted; therefore, natural flows entering the reservoir would be needed downstream to satisfy primary water rights within the Ute Indian Reservation.

This understanding was based primarily on the following information: the proposed hydroelectric plant associated with the White River Dam would be designed to produce power from releases of 250 cfs minimum to 600 cfs maximum according to information provided by Utah Division of Water Resources in the "White River Dam Project Proposed Action Plan," dated August 1979.

"The Proposed Action Plan" also stated that:

> "A minimum release rate of 250 cfs below the dam is proposed. If the past 50 years of record is indicative of the future then this flow could be assumed to be a guaranteed minimum flow. However, these records do not presume to guarantee anything not provided by nature. Emergency operations of the reservoir may require a minimum flow lower than that anticipated for short periods of time. These problems are not, however, foreseen at the present time and all design considerations will be taken to insure that emergency situations do not develop."

A change in anticipated water releases through the dam was provided by the Utah Division of Water Resources in an addendum, dated May 16, 1980, to the White River Dam Action Plan. It states,

> "The power plant will be designed to produce power from releases of 250 cfs minimum to 800 cfs maximum under a maximum head of 111 feet and a minimum of 66 feet. A minimum release to the White River below the dam of 250 cfs will be maintained."

> A letter from a representative of the Utah Division of Water Resources, dated September 19, 1980, to the BLM provided comments on the preliminary draft of the White River Dam Project Environmental Impact Statement. One comment said, "The reference to use flow releases of 250 cfs to 800 cfs is, of course, a reference to the range of the hydro electric plant... Our present information will be from 200 to 1,200 cfs. This information will not change the project's total use flow from the reservoir because with the numbers given (250 to 800 cfs) spills may be occurring which would make the flows in the river closer to the 200 to 1,200 cfs that we now plan to have used in the eventual design of the hydroelectric plant."

APPENDIX 3 (concluded)

During the 1980 Budget Session of the Utah State Legislature, a Bill was passed which endorsed a Ute Indian Water Compact. This proposed compact between the Ute Indian Tribe of the Uintah and Ouray Reservation, Utah and State of Utah was authorized and approved by the State of Utah; however, as of this date, September 1980, it has not been ratified by the Ute Indians.

The compact, recognizing the Winters Doctrine concerning Ute Indian water rights on the White River in Utah, would allocate and provide for delivery of water at a diversion point within the Indian Reservation (downstream from the proposed dam). The following quantities of water could be diverted from the river for use on the Reservation provided the natural river flows equal or exceed the amounts indicated:

Month	Acre-feet per Month	cfs per Month
April	2,036.10	33.9
May	10,590.50	176.5
June	13,640.39	227.3
July	13,486.17	224.8
August	12,181.47	203.0
September	7,562.55	126.0
October	2,087.31	34.8
Total	61,584.49	

The above allocations of water for specific months were developed by the Utah State Engineer and became part of the proposed compact between the State of Utah and the Ute Indian Tribe. These proposed allocations of water may change depending on the final agreement between the State of Utah and the Ute Indians.

In view of the proposed power plant design and because of the uncertainties associated with the final Indian Compact, including the eventual amount of water diversion and the actual date the Ute Indians would ratify the proposed compact, the BLM has accepted the release of 250 cfs minimum flow through the proposed White River Dam as a reasonable approximation for use in this EIS.

This minimum flow was utilized in impact analysis to estimate the environmental consequences should the White River Dam Project be approved and project features constructed.

APPENDIX 4

Cost Analysis Information By Alternative

TABLE A

Summary of Alternatives

Alternative	Construction Cost Total ($)	Construction Cost Annual ($/yr)	Annual Power Cost ($/yr)	Total Annual Cost ($/yr)	Quantity of Water Supplied (ac-ft)	Cost of Water ($/ac-ft/yr)
1. White River Dam	18,500,000	2,230,000	[a]--	2,230,000	70,000	32
3. Hell's Hole Canyon Dam to Augment White River	23,400,000	2,820,000	60,000	2,880,000	26,000	111
4. Pumping From Green River	51,200,000	6,170,000	2,060,000	8,230,000	70,000	118
5. Pumping From Green River to Augment White River	41,000,000	4,940,000	520,000	5,460,000	70,000	78

Source: Loren Anderson, BIO/WEST, 1980.

[a]Annual power income of approximately $1,150,000 (based on $0.04 per KWH) is not included in the comparison as it may not be applied to the water cost. Rather, it may be returned to the state water fund directly as a separate item.

APPENDIX 4 (continued)

TABLE B

Cost Analysis Information By Alternative
ALTERNATIVE 1: White River Dam and Reservoir

Work Description	Quantity	Unit Cost ($)	Total Estimated Cost ($)
1. General Conditions[a]	1	667,731.00	667,731
2. Site Preparation			
Clear Reservoir Basin	200 ac.	276.00	55,200
Clear Dam Foundation	24 ac.	822.80	19,747
River Diversion	300,000 cy	0.71	213,000
3. Excavation			
Excavate Cutoff Trench	80,000 cy	1.31	104,800
Dewatering	1	200,000.00	200,000
Rock Abutment Excavation	2,000 cy	10.05	20,100
Earth Spillway Excavation	1,000 cy	1.31	1,310
Rock Excavation	200,000 cy	10.05	2,010,000
4. Embankment			
Compacted Rock Fill	110,000 cy	0	0
Rip-Rap Truck Dumped	90,000 cy	15.45	1,390,500
Compacted Earth Fill	1,500,000 cy	1.85	2,775,000
Granular Zone Fill	200,000 cy	2.00	400,000
5. Concrete	1	4,819,679.00	4,819,679
6. Control Works	1	282,371.00	282,371
7. Access Roads	1	281,232.00	281,232
8. New Bridge and Highway Relocation	1	1,085,000.00	1,085,000
9. Land Aquisition	1	705,250.00	705,000
Subtotal			15,030,670
Contingencies, Engineering, Etc.			3,442,574
Estimated Total Costs (June 1979)			18,473,244
Annual Cost (I = 12%, N = .50 yr.)			2,224,500

$32/acre-feet/year.

[a]Inspection, survey, maps, staking, engineering.

APPENDIX 4 (continued)

TABLE C

Cost Analysis Information By Alternative
ALTERNATIVE 3: Hell's Hole Dam and Reservoir[a]

Work Description	Quantity	Unit Cost ($)	Total Estimated Cost ($)
Pipeline			
1. Place 54" Ø and Water Line	3,000 ft.	193.00	579,000
2. Trench Excavation	6,250 yd^3	0.90	6,000
3. Drilling and Blasting Rock	3,125 yd^3	27.00	84,000
4. Backfill	4,483 yd^3	1.00	5,000
Dam			
5. Site Preparation	300 ac.	370.00	111,000
6. Excavation	282,500 yd^3	7.56	2,136,000
7. Embankment	4,600,000 yd^3	2.38	10,948,000
8. Concrete for Spillway	6,500 yd^3	217.00	1,408,000
9. Grouting[b]	45,000 ft.	6.51	293,000
10. Control Works	1	282,000.00	282,000
Pump Station			
11. Pumps and Accessories	10	103,000.00	1,030,000
12. Pump Building	1	94,000.00	94,000
13. Settling Basin	1	174,000.00	174,000
14. Inlet Works	1	200,000.00	200,000
15. Access Road	1		654,000
16. Power Transmission Line	16,000 ft.	2.00	32,000
Subtotal			18,016,000
Contingencies, Engineering, etc @ 30%			5,405,000
Estimated Total Costs (June 1979)			23,421,000
Annual Cost (I - 12%, N - 50 yr.)			2,820,000
Annual Power Cost (Assumes pumping 1 mo/yr at 138 cfs electrical costs are $0.015/KWH)[c]			55,600

Footnotes

[a]This computation is based on the following component construction requirements:

Pumping Stations located on White River with settling basin, diversion structures, inlet works, etc.

Pipeline consists of a 3,000-foot-long, 54-inch diameter steel pipe with welded joints. Fifty percent rock operation and 50 percent common excavation assumed.

Dam - The embankment would contain 4,450,000 cy including 80,000 cy in the cutoff trench. The height would be approximately 294 feet for a 25,000 acre-foot reservoir capacity. Spillway capacity of 1,000 cfs and outlet capacity of 300 cfs assumed. (For a 70,000 acre-foot capacity reservoir, a 415-foot-high dam would be required.)

Access Road - Improvement of 13,000 feet of an existing road and construction of 8,000 feet of new road would be required for access to the dam.

Transmission Line - 16,000 feet of line to supply power for the pumps is assumed.

[b]Low because no good location for spillway.

[c]Although computer simulations based on historial hydrologic records indicate that pumping would occur on a frequency of 1 year in 50, the cost and energy analysis use the assumption noted above to simplify the analysis and in recognition of the fact that future water use in Colorado may increase the frequency of pumping.

APPENDIX 4 (continued)

TABLE D

Cost Analysis Information By Alternative
ALTERNATIVE 4: Pumping Water From the Green River[a]

Work Description	Quantity	Unit Cost ($)	Total Estimated Cost ($)
1. Place 54" and Water Line	153,120 ft.	193.00	29,552,000
2. Trench Excavation	319,000 yd^3	0.90	287,000
3. Drilling and Blasting Rock	159,500 yd^3	27.00	4,307,000
4. Backfill	228,300 yd^3	1.00	229,000
5. Pumps and Accessories	38	110,000.00	4,181,000
6. Pump Building	3	109,440.00	328,000
7. Settling Basin	1	174,000.00	174,000
8. Reserve Pond	1	118,000.00	118,000
9. Inlet Works	1	200,000.00	200,000
Subtotal			39,376,000
Contingencies, Engineering, etc @ 30%			11,813,000
Estimated Total Costs (June 1979)			51,189,000
Annual Cost (I - 12%, N - 50 yr.)			6,164,000
Annual Power Cost (assumes countinuous pumping of 97 cfs at $0.015/KWH)			2,058,218

[a]This computation is based on the following component construction requirements:
<u>Pumping Station</u> - One located on the Green River with diversion structures, inlet works, etc; one located about 1,000 ft. from the first station with a settling basin; and one located about 4.5 miles from the second station with a reserve pond.

<u>Pipeline</u> - Consists of a 29-mile-long, 54-inch diameter steel pipe with welded joints. Fifty percent rock excavation and 50 percent common excavation assumed.

APPENDIX 4 (concluded)

TABLE E

Cost Analysis Information By Alternative
ALTERNATIVE 5: Pumping Water From the White River and Supplementing With Water Pumped From the Green River[a]

Work Description	Quantity	Unit Cost ($)	Total Estimated Cost ($)
1. Place 36" Ø and Water Line	153,120 ft.	108.00	16,612,000
2. Trench Excavation	204,160 yd^3	0.90	184,000
3. Drilling and Blasting Rock	102,080 yd^3	27.00	2,756,000
4. Backfill	164,073 yd^3	1.00	164,000
5. Pumps and Accessories	7	1,442,000.00	10,094,000
6. Pump Building	7	109,440.00	766,080
7. Settling Basin	1	174,000.00	174,000
8. Reserve Pond	5	118,000.00	590,000
9. Inlet Works	1	200,000.00	200,000
Subtotal			31,540,000
Contingencies, Engineering, etc @ 30%			9,462,000
Estimated Total Costs (June 1979)			41,002,000
Annual Cost (I - 12%, N - 50 yr.)			4,937,000
Annual Power Cost (assumes pumping 1 mo./yr. at 97 cfs at $0.015/KWH)[b]			520,600

$78/acre-feet/yr.

Footnotes

[a] This computation is based on the following component construction requirements:

Pumping Station - The first station would be located on the Green River and would consist of diversion structures, inlet works, etc; the second would be located about 1,000 feet from the first with a settling basin; the third, about 2.5 miles from second with a reserve pond; the fourth, about 3.0 miles from the third with a reserve pond; the fifth, about 4.0 miles from the fourth with a reserve pond; the sixth, about 10.5 miles from the fifth with a reserve poind; the seventh, about 3.0 miles from the sixth with a reserve pond.

Pipeline - Consists of a 29-mile-long, 36-inch diameter steel pipe with welded joints. Fifty percent rock excavation and 50 percent common excavation assumed.

[b] Although computer simulations based on historical hydrologic records indicate that pumping would occur on a frequency of 1 year in 50, the cost and energy analysis use the assumption noted above to simplify the analysis and in recognition of the fact that future water use in Colorado may increase the frequency of pumping.

APPENDIX 5

Wildlife in the Project Area

TABLE A

Mammals, Their Status, Abundance and Habitat Preference in the General Area of the White River Dam

Status	Abundance	Habitat Type
P - Permanent Resident	C - Common	R - Riparian (Cottonwood)
S - Summer Resident	U - Uncommon	W - Wetlands, Ponds, Lakes
T - Transient	R - Rare	DS - Desert Shrub (Saltbush, Sagebrush, Greasewood)
	0 - Occasional	P-J - Pinyon-Juniper Woodland
	UK - Unknown	L - Literature
		0 - Observed in Impact Area
		- - Absent

Species	Status	Abundance	R	W	DS	P-J
Masked Shrew	P	UK	-	-	-	-
Wandering Shrew	P	UK	-	-	-	-
Dwarf Shrew	P	UK	-	-	-	-
Water Shrew	P	UK	-	-	-	-
Merriam's Shrew	P	UK	-	-	-	-
Little Brown Bat	S	U	L	0	-	-
Yuma Myotis	S	U	L	L	-	-
Long-eared Myotis	S	U	-	0	-	-
Fringed Myotis	S	R	-	-	-	-
Long-legged Myotis	S	U	-	0	-	-
California Myotis	S	U	-	0	-	-
Small-footed Myotis	S	U	-	0	-	-
Silver-haired Bat	S, T	C	L	0	-	-
Western Pipistrelle	S	C	L	0	L	-
Big Brown Bat	S	C	L	-	-	-
	S	R	-	0	-	-
Hoary Bat	S, T	C	L	0	-	-
Townsend's Big-eared Bat	S	R	-	0	-	-
Pallid Bat	S	U	-	0	-	-
Brazilian Free-tailed Bat	S	0	-	0	-	-
Mountain Cottontail	P	C-U	-	-	L	L
Desert Cottontail	P	C-R	0	-	0	0
White-tailed Jack-rabbit	P	U-R	L	-	0	0

(continued)

APPENDIX 5, TABLE A (continued)

Species	Status	Abundance	R	W	DS	P-J
Black-tailed Jack-rabbit	P	C-R	-	-	0	0
Least Chipmunk	P	C-U	-	-	-	0
Colorado Chipmunk	P	U-R	-	-	-	0
Yellow-bellied Marmot	T	U-R	-	-	0	-
White-tailed Antelope Squirrel	P	C-R	-	-	0	0
Thirteen-lined Ground Squirrel	P	U-R	-	-	L	-
Rock Squirrel	P	U-R	-	-	-	0
Golden-mantled Ground Squirrel	P	C-R	0	-	0	0
White-tailed Prairie Dog	P	C-R	-	-	0	-
Northern Pocket Gopher	P	U-R	-	-	L	-
Olive-backed Pocket Mouse	P	R-O	-	-	L	L
Apache Pocket Mouse	P	C-U	0	-	0	0
Ord's Kangaroo Rat	P	C-U	0	-	0	0
Beaver	P	C-U	0	-	-	-
Western Harvest Mouse	P	U-R	0	-	0	-
Canon Mouse	P	U	-	-	-	0
Deer Mouse	P	C-R	0	L	0	0
Brush Mouse	P	U-R	0	-	0	-
Pinon Mouse	P	U-R	-	-	0	0
Northern Grass-hopper Mouse	P	R-O	-	-	L	-
Desert Woodrat	P	C-R	-	-	0	0
Bushy-tailed Woodrat	P	C-R	0	-	0	0
Heather Vole	P	U-R	L	-	L	-
Long-tailed Vole	P	U-R	L	-	-	-
Sagebrush Vole	P	U-R	-	-	L	-
Muskrat	P	U-R	0	L	-	-
Porcupine	P	C-R	0	-	-	0
House Mouse	P	C-R	-	-	-	-
Coyote	P	U	0	L	0	0
Red Fox	P	U	L	-	-	-
Gray Fox	P	U-R	0	-	-	-
Ringtail	P	U-R	-	-	-	-
Raccoon	P	U-R	0	L	-	-
Black Bear	T	R	-	-	L	-
Long-tailed Weasel	P	R	-	-	-	0
Black-footed Ferret	UK	UK	-	-	L	-
Mink	P	U-R	L	-	-	-
Wolverine	UK	UK	-	-	-	-

(continued)

APPENDIX 5, TABLE A (continued)

Species	Status	Abundance	R	W	DS	P-J
Badger	P	U-R	O	L	O	O
Spotted Skunk	P	U-R	-	-	L	L
Striped Skunk	P	U	O	-	-	-
Otter	UK	UK	L	-	-	-
Mountain Lion	T	R	-	-	O	-
Bobcat	P	U-R	O	-	-	O
Mule Deer	P	C-U	O	L	O	O
Pronghorn	P	C-U	-	-	O	-
Wild Horse	P	U-R	-	-	L	-

Source: Armstrong 1972, Durrant 1952, Durrant et al. 1955, Grant and Kung 1979, Olsen 1973, Perry 1975, Ranck 1961, Smith and Assoc. 1979. Nomenclature: Armstrong 1972.

TABLE B

Birds, Their Status, Abundance and Habitat Preference in the General Area of the White River Dam

Status	Abundance	Habitat Type
P - Permanent Resident	C - Common	R - Riparian (Cottonwood)
S - Summer Resident	U - Uncommon	W - Wetlands, Ponds, Lakes
W - Winter Resident	R - Rare	DS - Desert Shrub
T - Transient	O - Occasional	P-J - Pinyon-Juniper Woodland
		L - Literature
		O - Observed in Impact Area
		- - Absent

Species	Status	Abundance	R	W	DS	P-J
Common Loon	T, W	U	L	L	-	-
Horned Grebe	T	R	L	L	-	-
Eared Grebe	S	C	L	L	-	-
Western Grebe	T	U	L	L	-	-
Pied-billed Grebe	T	R	-	L	-	-
White Pelican	T	R	-	L	-	-
Double-crested Cormorant	T	R	L	-	-	-
Great Blue Heron	S	U	O	L	-	-
Great Egret	T	R	-	L	-	-
Snowy Egret	S	U	-	L	-	-
	T	R	O	-	-	-
Black-crowned Night Heron	S	U	-	L	-	-
American Bittern	S	U	-	L	-	-
White-faced Ibis	T	U	-	L	-	-
Whistling Swan	T	R	-	L	-	-
Canada Goose	P	C	L	L	-	-
	S	C	O	-	-	-
Snow Goose	T	R	-	L	-	-
Mallard	P	C	L	L	-	-
	T		O			
Gadwall	S	C	L	L	-	-
	T	U	O			
Pintail	S	C	L	L	-	-
	T	U	O			
Green-winged Teal	S	C	L	L	-	-
	T	U	O			
Blue-winged Teal	T	U	O	L	-	-
Cinnamon Teal	S	C	L	L	-	-
	T	U	O			

(continued)

APPENDIX 5, TABLE B (continued)

Species	Status	Abundance	R	W	DS	P-J
American Widgeon	T	C	L	L	-	-
	T	U	O			
Northern Shoveler	S	C	L	L	-	-
	T	U	O			
Redhead	S	C	L	L	-	-
Ring-necked Duck	T	U	L	L	-	-
Canvasback	T	U	L	L	-	-
Lesser Scaup	T	U	L	L	-	-
Common Goldeneye	T, W	U	L	L	-	-
Barrow's Goldeneye	T, W	U	L	L	-	-
Bufflehead	T	U	L	L	-	-
Ruddy Duck	T	U	L	L	-	-
Common Merganser	W, T	U	O	L	-	-
Red-breasted Merganser	T	U	L	L	-	-
Turkey Vulture	S	C	O	L	O	L
Goshawk	W	U	O	-	-	O
Sharp-shinned Hawk	P	U	-	-	O	O
Cooper's Hawk	P, S	U	O	L	-	-
Red-tailed Hawk	P, S	C	O	-	O	O
Swainson's Hawk	T	R	-	-	O	-
Rough-legged Hawk	W	C	O	-	O	-
Ferruginous Hawk	T, S	R	-	-	O	-
Golden Eagle	P	C	O	-	O	O
Bald Eagle	W	U	O	L	O	-
Northern Harrier (Marsh Hawk)	P	U	L	L	O	-
Osprey	S	U	L	-	-	-
Prairie Falcon	P	U	-	-	O	O
Peregrine Falcon	T, S	R	O	-	O	-
Merlin	T	R	O	-	-	-
American Kestrel	S, P	C	O	L	O	O
Sage Grouse	P	U	-	-	L	-
California Quail	P	U	L	-	O	O
Ringnecked Pheasant	P	C	L	L	O	O
	T	R	O	-	O	-
Chukar	P	U	L	-	O	L
Sandhill Crane	T	C	O	L	-	-
Whooping Crane	T	R	O	-	-	-
Virginia Rail	S	U	L	O	-	-
Sora	S	U	-	L	-	-
American Coot	S	C	-	L	-	-
Semipalmated Plover	T	U	L	-	-	-
Snowy Plover	T	R	L	-	-	-
Killdeer	S	C	O	L	O	-
Mountain Plover	T	R	-	-	L	-
American Golden Plover	T	U	L	-	-	-
Black-bellied Plover	T	U	-	L	-	-

(continued)

APPENDIX 5, TABLE B (continued)

Species	Status	Abundance	R	W	DS	P-J
Common Snipe	S	C	L	L	-	-
	T	U	O			
Long-billed Curlew	S, T	U	L	L	-	-
Spotted Sandpiper	S	C	O	-	-	-
Solitary Sandpiper	T, S	U	-	L	-	-
Willet	T	U	L	L	-	-
Greater Yellowlegs	T	U	O	L	-	-
Lesser Yellowlegs	T	C	L	L	-	-
Baird's Sandpiper	T	U	L	L	-	-
Least Sandpiper	T	C	L	L	-	-
Dunlin	T	R	L	-	-	-
Western Sandpiper	T	U	L	-	-	-
Sanderling	T	U	L	L	-	-
Long-billed Dowitcher	T	U	L	L	-	-
Marbled Godwit	T	U	L	L	-	-
American Avocet	S	U	L	L	-	-
	T	U	O			
Black-necked Stilt	S	U	L	L	-	-
Wilson's Phalarope	S	C	L	L	-	-
Northern Phalarope	T	C	-	L	-	-
California Gull	T	U	L	L	-	-
Ring-billed Gull	T	R	L	-	-	-
Franklin's Gull	T	U	L	L	-	-
Forster's Tern	S	U	L	L	-	-
Caspian Tern	T	R	L	L	-	-
Black Tern	S	U	L	L	-	-
Rock Dove	P	U	L	-	-	-
Mourning Dove	S	C	O	L	O	O
Yellow-billed Cuckoo	S	U	O	-	-	-
Screech Owl	P	U	L	L	-	L
Great Horned Owl	P	C	O	L	O	O
Burrowing Owl	P	U	-	-	O	-
Long-eared Owl	P	U	O	L	L	-
Short-eared Owl	P	U	O	L	O	-
Poor-will	S	U	-	-	-	O
Common Nighthawk	S	C	O	L	O	O
Vaux's Swift	T	O	L	-	-	-
White-throated Swift	S	C	O	-	-	O
Black-chinned Hummingbird	S	U	O	-	-	L
Broad-tailed Hummingbird	S	C	O	L	O	O
Belted Kingfisher	P	U	O	-	-	-
Common Flicker	P	C	O	-	O	O
Red-headed Woodpecker	T	R	L	-	-	-
Lewis' Woodpecker	S	R	L	-	-	-

(continued)

APPENDIX 5, TABLE B (continued)

Species	Status	Abundance	R	W	DS	P-J
Yellow-bellied Sapsucker	W	U	0	-	-	-
Hairy Woodpecker	P	C	0	-	-	-
Downy Woodpecker	P	C	0	-	-	-
Eastern Kingbird	S	U	0	-	0	-
Western Kingbird	S	U	0	L	0	-
Ash-throated Flycatcher	S	C	0	-	-	0
Eastern Phoebe	T	R	0	-	0	-
Say's Phoebe	S	C	0	L	0	0
Willow Flycatcher	S	C	0	L	-	-
Gray Flycatcher	S	C	0	-	-	0
Western Wood Pewee	S	U	0	-	-	0
Olive-sided Flycatcher	T	U	0	-	-	-
Horned Lark	P	C	-	-	0	0
Violet-green Swallow	S	U	0	L	0	-
Tree Swallow	S	R	0	-	-	-
Bank Swallow	S	U	L	-	-	-
Rough-winged Swallow	S	C	0	L	-	-
Barn Swallow	S	C	L	L	-	-
	T	U	0			
Cliff Swallow	S	C	0	L	0	-
Scrub Jay	P	U	0	-	-	0
Black-billed Magpie	P	C	0	L	0	0
Common Raven	P	C	-	-	0	0
Common Crow	P	C	L	L	-	-
	T	R	0			
Pinon Jay	P	C	-	-	0	0
Clark's Nutcracker	P	0	-	-	-	0
Black-capped Chickadee	P	C	0	-	-	-
Mountain Chickadee	T	U	0	-	-	0
Plain Titmouse	P	C	-	-	-	0
Bushtit	T	U	0	-	-	0
White-breasted Nuthatch	T	U	0	-	-	-
Red-breasted Nuthatch	T	U	0	-	-	0
Brown Creeper	T	U	0	-	-	-
House Wren	S	U	0	-	-	-
Bewick's Wren	S	U	0	-	0	0
Long-billed Marsh Wren	S	R	-	0	-	-
Canon Wren	P	U	0	-	-	0
Rock Wren	S	C	0	-	0	0
Mockingbird	S	U	-	-	0	-

(continued)

APPENDIX 5, TABLE B (continued)

Species	Status	Abundance	R	W	DS	P-J
Gray Catbird	S	U	L	L	-	-
Bendire's Thrasher	T	O	-	-	O	-
Sage Thrasher	S	C	-	-	O	-
American Robin	S	C	O	L	-	O
Hermit Thrush	T	U	O	L	-	-
Swainson's Thrush	T	U	O	-	-	-
Western Bluebird	T	U	O	-	-	-
Mountain Bluebird	S, P	C	O	-	O	O
Townsend's Solitaire	T	U	O	-	-	O
Blue-gray Gnatcatcher	S	C	O	-	-	O
Black-tailed Gnatcatcher	S	O	O	-	-	O
Ruby-crowned Kinglet	T	U	O	-	O	O
Water Pipit	T	U	O	-	-	-
Cedar Waxwing	T	U	O	-	-	-
Northern Shrike	W	U	O	-	-	-
Loggerhead Shrike	S, P	C	-	-	O	-
Starling	S	C	O	-	O	-
Solitary Vireo	S	U	O	-	-	-
Red-eyed Vireo	T	O	O	-	-	-
Warbling Vireo	S	U	O	-	-	-
Orange-crowned Warbler	S	U	O	L	O	O
Virginia's Warbler	S	U	O	L	-	-
Yellow Warbler	S	C	O	L	-	-
Yellow-rumped Warbler	S, T	U	O	L	-	O
Black-throated Gray Warbler	S	C	O	-	-	O
Townsend's Warbler	T	U	O	-	-	-
Chestnut-sided Warbler	T	O	L	-	-	-
Northern Waterthrust	T	R	L	-	-	-
MacGillivray's Warbler	S	U	O	L	-	-
Common Yellowthroat	S	U	O	L	-	-
Yellow-breasted Chat	S	C	O	L	-	-
Wilson's Warbler	T	C	O	L	-	-
American Redstart	S	R	-	L	-	L
House Sparrow	P	C	L	-	-	-
Bobolink	T	O	-	L	-	-
Western Meadowlark	P	C	L	L	L	-
	S	C	O	-	O	-
Yellow-headed Blackbird	S	C	L	L	-	-

(continued)

APPENDIX 5, TABLE B (continued)

Species	Status	Abundance	R	W	DS	P-J
Red-winged Blackbird	P	C	L	L	-	-
	T	O	O			
Scott's Oriole	S	R	-	-	O	O
Northern Oriole	S	C	O	L	-	-
Brewer's Blackbird	P	C	O	L	O	-
Brown-headed Cowbird	S	C	O	L	-	-
Western Tanager	S	U	O	-	-	L
Rose-breasted Grosbeak	T	O	-	-	-	O
Black-headed Grosbeak	S	U	O	-	-	-
Blue Grosbeak	S	U	O	-	-	-
Lazuli Bunting	S	U	O	-	-	-
House Finch	S	C	O	L	-	O
Gray-crowned Rosy Finch	W	U	O	-	O	O
Black Rosy Finch	W	C	O	-	O	O
Pine Siskin	W, T	U	O	-	-	O
American Goldfinch	S	U	O	-	-	O
Lesser Goldfinch	T	R	O	-	-	-
Green-tailed Towhee	T	U	O	-	-	-
Rufous-sided Towhee	S	C	O	-	O	-
Lark Bunting	S	U	-	-	O	-
Savannah Sparrow	T	R	-	-	O	-
Vesper Sparrow	T, S	U	-	-	O	-
Lark Sparrow	S	C-U	O	-	O	O
Black-throated Sparrow	S	C-U	O	-	O	-
Sage Sparrow	S	C-U	-	-	O	-
Dark-eyed Junco	W	C	O	-	O	O
Gray-headed Junco	T	U	O	-	-	-
Tree Sparrow	W	U	O	L	-	-
Chipping Sparrow	S	C-U	O	-	-	O
Brewer's Sparrow	S	C-R	O	-	O	O
White-crowned Sparrow	S, T	U	O	L	-	-
Song Sparrow	P	U	O	L	-	-

Sources: Behle and Perry 1975a, b, Grant and Kung 1979, Grant et al. 1980, Hayward 1967, Hayward et al. 1958, 1979, Smith and Assoc. 1979, Twomey 1942. Nomenclature: Behle and Perry 1975a.

APPENDIX 5, Wildlife in the Project Area (continued)

TABLE C

Relative Abundance and Reproductive Status of Fishes in the White River of Utah

Species	Population Status[a]	Reproductive Status
Family Salmonidae - Trouts		
Brown Trout *Salmo trutta*	Oc	No
Family Cyprinidae - Minnows		
Carp *Cyprinus carpio*	C	Yes
Speckled Dace[b] *Rhinichthys osculus*	A	Yes
Colorado Squawfish[b] *Ptychocheilus lucius*	R	No
Roundtail Chub[b] *Gila robusta*	A	Yes
Humpback Chub[b] *Gila cypha*	Oc	No
Bonytail Chub[b] *Gila elegans*	Oc	No
Fathead Minnow *Pimephales promelas*	A	Yes
Red Shiner *Notropis lutrensis*	A	Yes
Family Catostomidae - Suckers		
Bluehead Sucker[b] *Pantosteus discobolus*	C	Yes
Flannelmouth Sucker[b] *Catostomus latipinnis*	A	Yes
Family Ictaluridae - Catfishes		
Channel Catfish *Ictalurus punctatus*	C	?

(continued)

APPENDIX 5, TABLE C (continued)

Species	Population Status[a]	Reproductive Status
Black Bullhead *Ictalurus melas*	C	?
Family Centrarchidae - Sunfishes		
Green Sunfish *Lepomis cyanellus*	R	?
Smallmouth Bass *Micropterus dolomieui*	Oc	No

Source: Utah Division of Wildlife Resources 1976, Lanigan and Berry 1979, Holden and Selby 1979.

[a]A = abundant - The species was collected at will with standard equipment and little effort. Several age groups were present indicating stable reproducing populations. Juveniles were readily taken in one or more habitats by seine.

C = common - The species, especially juveniles, was readily collected. Usually more than one age group was represented, suggesting reproduction in the area.

R = rare - The species was collected occasionally but with no certainty regardless of effort expended.

Oc = occasional - Occurrence of the species was due to stocking or movement into the area during a particular season, such as winter, or only one or two specimens had been collected.

[b]Native.

APPENDIX 5, Wildlife in the Project Area (continued)
TABLE D

Relative Abundance and Reproductive Status of Fishes
In the Green River Below Walker Hollow

Species	Population Status[a]	Reproductive Status
Family Cyprinidae - Minnows		
Utah Chub _Gila atraria_	Oc	No
Roundtail Chub[b] _Gila robusta_	C	Yes
Bonytail Chub[b] _Gila elegans_	R	?
Humpback Chub[b] _Gila cypha_	R	Yes
Colorado Squawfish[b] _Ptychocheilus lucius_	R	Yes
Speckled Dace[b] _Rhinichthys osculus_	C	Yes
Redside Shiner _Richardsonius balteatus_	R	?
Fathead Minnow _Pimephales promelas_	C	Yes
Carp _Cyprinus carpio_	C-A	Yes
Red Shiner _Notropis lutrensis_	A	Yes
Creek Chub _Semotilus atromaculatus_	Oc	No
Family Catostomidae - Suckers		
Razorback Sucker[b] _Xyrauchen texanus_	R	?
Mountain Sucker[b] _Pantosteus platyrhynchus_	Oc	No

(continued)

APPENDIX 5, TABLE D (continued)

Species	Population Status[a]	Reproductive Status
Bluehead Sucker[b] *Pantosteus discobolus*	C-A	Yes
Flannelmouth Sucker[b] *Catostomus latipinnis*	A	Yes
White Sucker *Catostomus commersoni*	Oc	No
Family Cottidae - Sculpins		
Mottled Sculpin[b] *Cottus bairdi*	Oc	No
Family Ictaluridae - Catfishes		
Channel Catfish *Ictalurus punctatus*	A	Yes
Black Bullhead *Ictalurus melas*	R	Yes
Family Esocidae - Pikes		
Northern Pike[c] *Esox lucius*	Oc	No
Family Centrarchidae - Sunfishes		
Green Sunfish *Lepomis cyanellus*	R	Yes
Largemouth Bass *Micropteus salmoides*	R	No
Smallmouth Bass *Micropterus dolomioui*	Oc	No

APPENDIX 5, TABLE D (concluded)

Species	Population Status[a]	Reproductive Status
Family Percidae - Perches		
Walleye		
Stizostedion vitreum	Oc	No

Sources: Holden 1977, Holden and Selby 1979b.

[a]A = abundant - The species was collected at will with standard equipment and little effort. Several age groups were present indicating stable reproducing populations. Juveniles were readily taken in one or more habitats by seine.

C = common - The species, especially juveniles, was readily collected. Usually more than one age group was represented, suggesting reproduction in the area.

R = rare - The species was collected occasionally but with no certainty regardless of effort expended.

Oc = occasional - Occurrence of the species was due to stocking or movement into the area during a particular season, such as winter, or only one or two specimens had been collected.

[b]Native.

[c]Northern pike were captured in the Green River in 1976 by the Colorado River Fishes Recovery Team, in 1980 by BIO/WEST at Jensen (Personal communication, Paul B. Holden, BIO/WEST, Inc., Logan, Utah).

APPENDIX 6

Visual Resource Definitions, Bonanza Planning Unit
Vernal BLM District

Scenic Quality

Class A Scenery - Areas containing interesting rock formations, a variety of contrasting colors of rock, soil, and flowing water, variety of texture and form of vegetation, lacking man-made intrusions, and unique.

Class B Scenery - The features of Class B scenery are interesting within their settings, but similar to others within the region.

Class C Scenery - Contains a lack of interesting landform or vegetation and extent of man-made intrusion make landscape features common within the region.

Distance Zones

Foreground/Middleground - The area that can be seen from each travel route for a distance of 3 to 5 miles where management activities might be viewed in detail. The outer boundary of this zone is the point where the texture and form of individual plots is no longer apparent in the landscape.

Background - The remaining area which can be seen from each travel route to approximately 15 miles. This does not include areas in the background which are so far distant that the only thing discernable is the form or outline. In order to be included within the distance zone, vegetation should be visible at least as patterns of light and dark.

Seldom Seen - These lands are identified through the seen area analysis as unseen or beyond the approximate 15-mile limit from points of observation.

Sensitivity Levels

Visual Sensitivity Levels are used to indicate the degree of user interest in visual resources and concern for changes in the existing landscape character. The labels high, medium, and low are assigned according to a set of criterion from BLM Manual 8411.31A.

(continued)

Visual Resource Management Classifications

Class I - This class provides primarily for natural ecological changes; however, it does not preclude very limited management activity. Any contrast created within the characteristic environment must not attract attention. It is applied to wilderness areas, some material areas, wild portions of wild and scenic rivers, and other similar situations where management activities are to be restricted.

Class II - Changes in the basic elements (form, line, color, texture) caused by a management activity should not be evident in the characteristic landscape. A contrast may be seen, but should not attract attention.

Class III - Contrasts to the basic elements (form, line, color, texture) caused by a management activity may be evident and begin to attract attention in the characteristic landscape. However, the changes should remain subordinate to the existing characteristic landscape.

Class IV - Contrasts may attract attention and be a dominant feature of the landscape in terms of scale; however, the change should repeat the basic elements (form, line, color, texture) inherent in the characteristic landscape.

Class V - Change is needed or change may add acceptable visual variety to an area. This class applies to areas where the material character has been disturbed to a point where rehabilitation is needed to bring it back into character with the surrounding landscape.

Source: Flores Associates (1979).

APPENDIX 7

Revegetation Program for Disturbed Areas

Successful revegetation of disturbed sites under the environmental conditions of the White River Dam Project area (limited and erratic precipitation, great temperature extremes, and shallow soils of low fertility and often high salinity) requires a program which proceeds in a logical and coordinated fashion. The proposed program consists of four major components: (1) plant selection; (2) plant propagation; (3) site preparation and field planting; and (4) management of planted areas.

Plant Selection

Native plant species are generally preferred because they are adapted to the arid climate of the project area and are best suited to provide the food and habitat requirements of indigenous wildlife. Because ecological tolerances of native species may differ from region to region, and even from site to site, it is desirable that the source of plant materials be as close to the site to be revegetated as possible. Native and non-native plants from outside the immediate project area should not be ignored, but they should first be tested for adaptation before being included in the revegetation program. A variety of plant species and life forms should be planted to provide community diversity and ecological stability. Deep rooted trees and shrubs help prevent mass soil slippage, while forbs and grasses provide ground cover and reduce surface soil erosion. Plant species should also be selected for their palatability characteristics. Mixtures of plant species may provide a better diet for both livestock and wildlife. Plant species of moderate palatability should be included with highly palatable species to prevent overgrazing.

Plant Propagation

An adequate and reliable source of plant material is essential to the project area revegetation program. The most effective planting materials will generally be bare-root or container-grown planting stock rather than seeds due to the poor success of direct seeding on arid sites where 7 to 10 inches (175 to 250 mm) of precipitation occurs. Depending on the plant species, plant materials can be propagated by seed, wildings (naturally produced seedlings), root sprouts, vegetative stem cuttings, grass sprigs, grass Huzomatous sprouts, and bunch division. Propagation methods, ease of propagation, collection dates, and special treatments for several native plant species in the project area are described by the Institute for Land Rehabilitation (1979a, 1979b). Container-grown plants are expensive, but under adverse growing conditions they provide the best means of establishing vegetation. This is especially evident for plantings made later in the growing season than early spring.

Site Preparation and Field Planting

For greatest survival, bare-root stock and wildings should be planted in early spring while the plants are still dormant. It is necessary that the roots be kept moist and not be allowed to dry while digging, transporting, or planting.

Container stock grown during the winter in the greenhouse should be gradually hardened to external conditions over a several week period if they

are to be field planted in early spring. Later plantings of container-grown stock do not require the same degree of hardening as early spring plants if the transplants have good root and top development. Small container-grown plants can be planted early in the spring when the soil is moist. Summer and fall plantings require larger transplants grown in larger containers. These later plantings may need supplemental water when planted; the amount depending on the dryness of the soil. Container-grown plants need to be tamped in well to provide a close contact between the potting soil material and the surrounding disturbed soil.

Site preparation on the project area will vary with the type of disturbance, type of soil material, slope, soil compaction, and plant competition. Compacted soil such as a roadway must be loosened to allow for moisture penetration and root growth. Weedy plant competition should be removed and then the area fallowed for moisture accumulation. Slopes, basins, furrows, or other techniques for water harvesting or erosion control should be established at the time of fallowing.

Species being planted should fit the habitat as much as possible and blend in with those species growing naturally. Much of the criteria for plant spacing, species selection, and mixing of species can be developed in part from environmental baseline data from Federal Oil Shale Tracts Ua and Ub (VTN Colorado, Inc. 1976). Distance between plants should not exceed average interspace distances found in the surrounding undisturbed area. Direct seeding of arid sites is not generally advised unless soil moisture is high and/or supplemental irrigation is possible. Transplanting of bare root and container-grown species is thus the recommended practice for critical arid sites. Supplemental water and fertilizer are recommended primarily when the soil is dry and low fertility is indicated.

Management of Planted Areas

Continued management of revegetated areas is critical to insure high plant survival. Grazing of young plants by wildlife and domestic livestock can reduce plant survival. Weedy species may deplete soil moisture to the extent that the vigor of transplants will be reduced. Fencing and repellents control grazing animals in many instances, but the first method is expensive and the latter requires considerably more research before it can be relied upon. The best way to reduce the effects of grazing animals is with large transplants, clear plant interspaces, planting large areas at one time and including several species that are of low to moderate palatability to the problem animals. In years of average or above average precipitation excellent field survival of transplants of adapted species can be achieved without supplemental irrigation. However, during extreme drought years, supplemental irrigation may be essential to insure adequate plant survival. In any case, no additional irrigation should be needed after the first growing season following transplanting.

Conclusion

The final revegetation program must be determined by the resource manager; however, the above guidelines for the revegetation program for disturbed areas provide basic information and thus aid in the selection of measures to meet specific sites requirements. Each disturbed site must be evaluated prior to the selection of the best method for rehabilitation.

APPENDIX 8

Energy Accounting for Construction of the
White River Dam and Alternatives

Appendix 8 provides the results of the energy analysis for each alternative. The following items clarify use of the table:

1. In order to provide a common base for analysis, all dollar figures have been deflated to 1967 levels using the general deflators: 1978 = 196.4 and 1979 = 217.4.

2. All conversion factors are in Btu/dollars unless noted otherwise.

3. Primary conversion source is Bullard, et al. (1976), unless indicated otherwise. The first column is the national sector number from Bureau of Budget (1967) and the second column is the Bullard aggregated sector number. Evaluations of comparability between the two were made in numerous cases to ensure accuracy.

Component	Source		Conversion (Btu/$)	1967 Dollars or Cubic Yards	Btu/Item
			ALTERNATIVE 1 - White River Dam		
General Conditions					
Supervision	8911	344	28,103	$3.66x10^4$	$1.03x10^9$
Inspection	8911	344	28,103	$3.055x10^4$	$8.585x10^8$
Survey and Stake	8911	344	28,103	$5.87x10^4$	$1.65x10^9$
Timekeeper and Clerk	8911	344	28,103	$1.59x10^4$	$4.46x10^8$
Field Engineer	8911	344	28,103	$3.3x10^4$	$9.27x10^8$
Mobilization and Demobilizaton		342	30,807	$3.05x10^4$	$9.41x10^8$
Reports		344	28,103	$1.27x10^4$	$3.58x10^8$
Hand Tools	3423	207	70,911	$1.78x10^3$	$1.26x10^8$
Equipment Rental and Repair		253	69,072	$1.22x10^4$	$8.44x10^8$
Shop Drawings and Samples	8911	344	28,103	$1.12x10^3$	$3.15x10^7$
Offices	1511	23	59,340	$3.67x10^3$	$2.18x10^8$
Sheds	1511	23	59,340	$6.11x10^3$	$3.63x10^8$
Telephone and Telegraph	4811	327	22,085	$3.67x10^3$	$8.1x10^7$
Heating		5	11,077	$9.78x10^2$	$1.08x10^7$
Electric		4	38,951	$1.1x10^3$	$4.28x10^7$
Water		329	11,453	$1.47x10^3$	$1.68x10^8$
Sanitary Facilities		329	11,453	$1.1x10^3$	$1.26x10^8$
Access Road		26	125,758	$4.58x10^4$	$5.76x10^9$

APPENDIX 8 (continued)

Component	Source		Conversion (Btu/$)	1967 Dollars or Cubic Yards	Btu/Item
Winter Protection	1511	24	72,491	$3.05x10^3$	$2.21x10^8$
Trucks and Travel		321	81,717	$1.32x10^4$	$1.08x10^9$
Subtotal				$3.13x10^5	$1.53x10^{10}$ BTU
Site Preparation					
Clear Reservoir Basin		29	61,453	$2.55x10^4$	$1.57x10^9$
Clear Dam Foundations		29	61,453	$9.4x10^3$	$5.77x10^8$
River Diversion		Bell	$6.36x10^4$ Btu/cy	300,000cy	$1.91x10^{10}$
Subtotal				$1.34x10^5$	$2.12x10^{10}$
Excavate Cutoff Trench		Bell	$6.36x10^4$ Btu/cy	80,000 cy	$5.09x10^9$
De-watering	4617	325	121,420	$4.07x10^4$	$4.95x10^9$
Rock Abutment Exc.		Bell	$6.36x10^4$ Btu/cy	2,000 cy	$1.27x10^8$
Earth Spillway Exc.		Bell	$6.36x10^4$ Btu/cy	1,000 cy	$6.36x10^7$
Rock Exc.		Bell	$6.36x10^4$ Btu/cy	200,000 cy	$1.27x10^{10}$
Subtotal				$4.878x10^5	$2.29x10^{10}$
Embankment					
Compacted Rockfill		Bell	$6.36x10^4$ Btu/cy	110,000 cy	$7x10^9$
Rip-rap Truck Dumped			$6.36x10^4$ Btu/cy	90,000 cy	$5.72x10^9$
Compacted Earth Fill			$6.36x10^4$ Btu/cy	1,500,000 cy	$9.54x10^{10}$
Granular Zone Fill			$6.36x10^4$ Btu/cy	200,000 cy	$1.27x10^{10}$
Subtotal				$1.26x10^6	$1.2084x10^{11}$
Concrete					
Grout Foundation		163	113,551	1.37×10^5	$1.56x10^{10}$
Connections		163	113,551	$4.07x10^3$	$4.63x10^8$
Cement Sacks		153	501,726	$7.64x10^4$	$3.83x10^{10}$
Concrete Spillways		Bell	$2.43x10^7$ Btu/cy	10,400 cy	$2.53x10^{11}$
Concrete Penstock Encasement		Bell	$2.43x10^7$ Btu/cy	4,700 cy	$1.14x10^{11}$
Concrete Fill		Bell	$2.43x10^7$ Btu/cy	500 cy	$1.22x10^{10}$
Concrete Out/inlet		Bell	$2.43x10^7$ Btu/cy	1,000 cy	$2.43x10^{10}$

APPENDIX 8 (continued)

Component	Source	Conversion (Btu/$)	1967 Dollars or Cubic Yards	Btu/Item
Concrete Reinforcement Bars	Hannon	15,664 Btu/lb	$2.55x10^6$ lb	$3.99x10^{10}$
Concrete Intake Tower	Bell	$2.43x10^7$ Btu/cy	1,000 cy	$2.43x10^{10}$
Overflow Wier	Bell	$2.43x10^7$ Btu/cy	2,800 cy	$6.8x10^{10}$
Operating Platform for Gate	163	113,551	$2.55x10^3$	$2.89x10^8$
Subtotal			$\$2.262x10^6$	$5.3598x10^{11}$
Control Works				
Steel Pipe 36"	3317 175 Btu/cy	227,392	$2.81x10^4$	$7.803x10^9$
HB Valve 36"	3317 175 Btu/cy	277,392	$4.583x10^4$	$1.27x10^{10}$
Trash Rack and Misc. Mat.	3317 175 Btu/cy	277,392	$7.64x10^3$	$2.12x10^9$
Abutment and Toe Drain	3317 175 Btu/cy	277,392	$2.04x10^4$	$5.65x10^9$
Steel Gates	3442 199	123,997	$3.06x10^4$	$3.79x10^9$
Subtotal			$\$1.33x10^5$	$3.207x10^{10}$
Access Roads				
Bridge at Spillway	3411 198	131,635	$4.07x10^4$	$5.36x10^9$
Road at Dam (Alt. A and C)	26	125,758	$2.29x10^4$	$2.88x10^9$
Road Stabilized	29	61,453	$4.15x10^4$	$2.55x10^9$
Road Improved	29	61,453	$2.68x10^4$	$1.65x10^9$
Subtotal			$\$1.319x10^5$	$1.244x10^{10}$
Totals			$4.72x10^6$	$7.6x10^{11}$ Btu
Design Contingency	5% Gillard $/GNP	$1.925x10^4$	$2.36x10^5$	$4.55x10^9$
Design Fees	5% 344	28,103	$2.48x10^5$	$6.97x10^9$
GRAND TOTALS			$\$5.2x10^6$	$7.72x10^{11}$ Btu
Annual Power Produced at Hydroelectric Power Plant		3,413 Btu/KWH	29 million KWH	$9.9x10^{10}$ Btu

ALTERNATIVE B ACCESS ROAD

Component	Source	Conversion (Btu/$)	1967 Dollars or Cubic Yards	Btu/Item
New Road	26	125,758	$7.73x10^5$	$9.72x10^{10}$ Subtotal
Bridge at Spillway	3441 198	131,635	$1,38x10^5$	$1.82x10^{10}$
Total (with Option)			$\$9.11x10^5$	$1.15X10^{11}$

APPENDIX 8 (continued)

Component	Source		Conversion (Btu/$)	1967 Dollars or Cubic Yards	Btu/Item
			ALTERNATIVE D ACCESS ROAD		
Excavation		Bell	6.36×10^4 Btu/cy	360,000 cy	2.29×10^{10}
Rip Rap		Bell	6.36×10^4 Btu/cy	5,000 cy	3.18×10^8
Road Base			6.36×10^4 Btu/cy	3,600	2.29×10^9
Guardrail	3444	201	120,960	1.66×10^4	2.0×10^9
Steel Bridge	3441	198	131,635	4.14×10^5	5.45×10^{10}
Total				$\$1.12\times10^6$	8.2×10^{10}
			ALTERNATIVE E ACCESS ROAD		
New Road		26	125,758	5.52×10^5	6.94×10^{10}
Steel Bridge	3441	198	131,635	2.3×10^6	3.03×10^{11}
				$\$2.85\times10^6$	3.72×10^{11} Btu
			ALTERNATIVE 3 - Hell's Hole Reservoir		
54" Water Line		175	277,392	2.66×10^5	7.39×10^{10}
Trench Excavation	Bell		6.36×10^4 Btu/cy	6,250 cy	3.98×10^8
Drilling and Blasting Rock	Bell		6.36×10^4 Btu/cy	3,125 cy	1.99×10^8
Backfill	Bell		6.36×10^4 Btu/cy	4,483 cy	2.85×10^8
Site Preparation		29	61,453	5.11×10^4	3.14×10^9
Excavation	Bell		636×10^4 Btu/cy	282,500 cy	1.8×10^{10}
Embankment	Bell		636×10^4 Btu/cy	4,600,000 cy	2.93×10^{11}
Concrete	Bell		2.43×10^7 Btu/cy	6,500 cy	1.58×10^{11}
Grouting		163	113,551	1.35×10^5	1.53×10^{10}
Countrol Works			See Key	1.3×10^5	1.11×10^{10}
Pumps and Accessories		237	59,006	4.74×10^5	2.8×10^{10}
Pump Building		23	59,340	3.64×10^4	2.16×10^9
Pump Building Earthwork	Bell		6.36×10^4 Btu/cy	504 cy	3.21×10^7
Pump Building Concrete	Bell		2.43×10^7 Btu/cy	65 cy	1.58×10^9
Settling Basin					
Earthwork	Bell		6.36×10^4 Btu/cy	30,000 cy	1.9×10^9
Plastic Liner		133	226,289	3.82×10^4	8.64×10^9

APPENDIX 8 (continued)

Component	Source	Conversion (Btu/$)	1967 Dollars or Cubic Yards	Btu/Item
Concrete Wier	Bell	2.43×10^7 Btu/cy	144	3.5×10^9
Steel Gates	199	123,997	9.2×10^3	1.14×10^9
Reserve Pond				
Earthwork	Bell	6.36×10^4 Btu/cy	26,000 cy	1.65×10^9
Plastic Liner	133	226,289	3.85×10^4	8.71×10^9
Inlet Works	Bell	2.43×10^7 Btu/cy	899 cy	2.16×10^{10}
Roads				
Improve	29	61,453	4.05×10^5	2.49×10^{10}
New	26	125,758	2.49×10^5	3.13×10^{10}
Work Description				
Power Transmission Line	25	85,922	1.47×10^4	1.26×10^9
Subtotal			$\$8.29 \times 10^6$	7.09×10^{11}
Contingencies				
10% Total Engineering	344	28,103	8.29×10^5	2.33×10^{10}
20% Total General	Gillard	1.925×10^4	1.66×10^6	3.19×10^{10}
Total			$\$1.08 \times 10^7$	7.64×10^{11}
Annual Power Use (assumes pumping 138 cfs for 1 month per year)		3,413 Btu/KWH	3.71×10^6 KWH	1.26×10^{10}

ALTERNATIVE 4 - Pumping From Green River

Component	Source	Conversion (Btu/$)	1967 Dollars or Cubic Yards	Btu/Item
54" Water Line	3317 175	277,392	1.36×10^7	3.77×10^{12}
Trench Evacuation	Bell	6.36×10^4 Btu/cy	319,000 cy	2.03×10^{10}
Drilling and Blasting Rock	Bell	6.36×10^4 Btu/cy	159,500 cy	1.01×10^{10}
Backfill	Bell	6.36×10^4 Btu/cy	228,800 cy	1.46×10^{10}
Pumps and Accessories	237	59,006	1.92×10^6	1.13×10^{11}
Pump Building	23	59,340	4.1×10^4	2.43×10^9
Pump B. Earthwork	Bell	6.36×10^4 Btu/cy	415 cy	2.64×10^7
Pump B. Concrete	Bell	2.43×10^7 Btu/cy	88 cy	2.14×10^9

APPENDIX 8 (continued)

Component	Source	Conversion (Btu/$)	1967 Dollars or Cubic Yards	Btu/Item
Settling Basin				
Earthwork	Bell	6.36×10^4 Btu/cy	30,000 cy	1.91×10^9
Plastic Liner	133	226,289	3.82×10^4	8.64×10^9
Concrete Wier	Bell	2.43×10^7 Btu/cy	144 cy	3.5×10^9
Steel Gates	199	123,997	9.2×10^3	1.14×10^9
Reserve Pond				
Earthwork	Bell	6.36×10^4 Btu/cy	26,000 cy	1.65×10^9
Plastic Liner	133	226,289	3.85×10^4	8.71×10^9
Inlet Works	Bell	2.43×10^7 Btu/cy	889 cy	2.16×10^{10}
Subtotal			$\$1.81\times10^7$	3.98×10^{12} Btu
Contingencies				
20% Total (General)	Gillard	1.92×10^4	3.62×10^6	6.95×10^{10}
10% Total (Engineering)	344	28,103	1.81×10^6	5.09×10^{10}
Total Cost			$\$2.35\times10^7$	4.1×10^{12} Btu
Annual Power Use (assumes pumping, 97 cfs continuously)	Hook	3,413 Btu/KWH	1.37×10^8 KWH	4.68×10^{11} Btu

ALTERNATIVE 5 - Green and White River Pumping

Component	Source	Conversion (Btu/$)	1967 Dollars or Cubic Yards	Btu/Item
Place 36" Water Line	175	277,392	7.64×10^6	2.12×10^{12}
Trench Evacuation	Bell	6.36×10^4 Btu/cy	204,160 cy	1.3×10^{10}
Drilling and Blasting Rock	Bell	6.36×10^4 Btu/cy	102,080 cy	6.49×10^9
Backfill	Bell	6.36×10^4 Btu/cy	164,073 cy	1.04×10^{10}
Pumps and Accessories	237	59,006	1.92×10^6	1.13×10^{11}
Pump Building	23	59,340	4.1×10^4	2.43×10^9
Pump Building Earthwork	Bell	6.36×10^4 Btu/cy	415 cy	2.64×10^7
Pump Building Concrete	Bell	2.43×10^7 Btu/cy	88 cy	2.14×10^9

APPENDIX 8 (concluded)

Component	Source		Conversion (Btu/$)	1967 Dollars or Cubic Yards	Btu/Item
<u>Settling Basin</u>					
Earthwork	Bell		6.36×10^4 Btu/cy	30,000 cy	1.91×10^9
Plastic Liner		133	226,289	3.82×10^4	8.64×10^9
Concrete Wier	Bell		2.43×10^7 Btu/cy	144 cy	3.5×10^9
Steel Gates		199	123,997	9.2×10^3	1.14×10^9
<u>Reserve Pond</u>					
Earthwork	Bell		6.36×10^4 Btu/cy	26,000 cy	1.65×10^9
Plastic Liner		133	226,289	3.8×10^4	8.71×10^9
Inlet Works	Bell		2.43×10^7 Btu/cy	889 cy	2.16×10^{10}
Subtotal				$\$1.14 \times 10^7$	2.31×10^{12}
Contingencies					
20% Total (General)	Gillard		1.925×10^4	2.27×10^6	4.38×10^{10}
10% Total Engineering		344	28,103	1.14×10^6	3.2×10^{10}
Total Cost				$\$1.48 \times 10^7$	2.39×10^{12} Btu
Annual Power Use (assumes pumping 97 cfs for 1 month per year)			3,533 Btu/KWH	3.47×10^{10} KWH	1.18×10^{11} Btu

GLOSSARY

ACRE-FOOT. The volume of water (43,560 cubic feet) that would cover 1 acre to a depth of 1 foot.

ALGAL LIMESTONE. A limestone composed largely of remains of calcium-secreting algae or one in which such algae serve to bind together the fragments of other calcium-secreting forms.

AQUIFER. A water-bearing stratum of permeable rock, sand, or gravel.

ARMORING. The process of removing fine particles (sand and clays) from a stream bed and leaving the substrate covered with large cobbles and boulders.

ASSYMETRIC. One side steeper than the other (as in an assymetric valley).

ANIMAL UNIT MONTH (AUM). The amount of forage required by a cow with a calf, or their equivalent, for one month.

BORROW MATERIAL. Material (sand, gravel, etc.) excavated.

COBBLES. Stones larger than pebbles, smaller than boulders.

COLIFORM. Colon (intestinal) bacillus bacteria.

CONGLOMERATE. A coarse-grained sedimentary rock of rounded fragments larger than 2 mm in diameter set in a fine grained matrix of sand, silt, or any of the common material cementing materials. The coarse grains are fragments of pre-existing rocks.

DOWNSTREAM TOE. The lowest part of a dam facing in the direction of the flow of a stream.

DRAWDOWN. A lowering of the water level of a reservoir.

EOCENE EPOCH. An early epoch of the Tertiary Period of the Cenozoic Era. It is thought to have covered the span of time between 58 and 36 million years ago.

ESCARPMENT. The steep slope of a cliff.

FAULT. A surface or zone of rock fracture along which there has been replacement.

FLOODPLAIN. Land areas susceptible to being flood-inundated from any source, including small and often dry watercourses and areas adjoining coastal waters, areas along rivers, streams, and lakes.

FORMATION. The basic rock-stratigraphic unit in the local classification of rocks consisting of a body of rock generally characterized by some degree of internal homogeneity or distinction features.

GILSONITE. A black, shiny, hard asphalt.

GROUT. A thin mortar used for filling spaces.

HUNTER DAY. One hunter hunting for a day or a part of a day.

JOINT. A fracture in a rock. A joint differs from a fault in lacking displacements on opposite sides of the fracture.

LIMESTONE. A sedimentary rock consisting chiefly of calcium carbonate, primarily in the form of the mineral calcite.

LITHIC SCATTER. An archaeological site characterized by the presence of flaked tools, chips, cores or flake only.

MAINSTEM FLOW. Movement of the main course of a stream.

MARLSTONE. A rock consisting of approximately equal amounts of carbonate and clay.

OBLIGATE SPECIES. A species for which a change in habitat will directly influence its population, either favorably or unfavorably.

OIL SHALE. A marlstone which is rich in kerogen (distillable hydrocarbons).

100-YEAR FLOOD. A flood which occurs at a frequency of once every 100 years.

PENSTOCK. A conduit or pipe for conducting water through a dam.

PHYTOPLANKTON. Passively floating or weak swimming minute plant life of a body of water.

PROTOHISTORIC. Of a time that immediately antedates recorded history.

QUATERNARY PERIOD. The second period of the Cenozoic Era. It is thought to have covered the last two or three million years.

RECONNAISSANCE LEVEL STUDIES. Rather undetailed studies used for preliminary examinations and comparisons.

RIPARIAN. Of or relating to or living or located on the bank of a watercourse (river or stream).

RIPARIAN HABITAT. A specialized form of wetland restricted to areas along, adjacent to, or contiguous with perennially and intermittently flowing rivers and streams; also, periodically flooded lake and reservoir shore areas, as well as lakes with stable water levels with characteristic vegetation. This habitat is transitional between true bottom land wetlands and upland terrestrial habitats and, while associated with water courses, may extend inland for considerable distance.

RIPRAP. A sustaining wall of large boulders thrown together without order as on an embankment slope to prevent erosion.

RIVER VALLEY ALLUVIAL DEPOSITS. Loose rock material deposited over time in the floodplain of a meandering river.

ROCK STRUCTURE. The general geometric arrangement of rock masses following such processes as folding, faulting, jointing, etc.

SEDIMENT LOAD. The material (solid particles and dissolved compounds) transported by a river.

SEISMIC. Pertaining to an earthquake or earth vibration.

SENSITIVE SPECIES. Any species which may be a candidate for the Federal Threatened and Endangered Species List; a rare or infrequent species whose small populations are so widely dispersed or ranges so narrowly restricted that any reduction in numbers or changes in habitat might lead toward extinction; a species whose numbers are declining so rapidly because of one or more factors such as disease, grazing, predation, etc., that official listing may become necessary as a conservation measure.

SETS (OF JOINTS). Two or more parallel joints.

SHALE. A rock composed of particles less than 1/256 mm in diameter in thin layers.

SILTSTONE. A rock composed of silt-size (1/16-1/256 mm) and clay size (less than 1/256 mm) particles.

SPOIL. Excavated material such as earth and rock. Usually from mining, dredging, or digging activities.

STILLING BASIN. A small, deep body of water used for energy dissipation.

STRATA. Plural of stratum. Stratum is a tabular or sheet-like layer of sedimentary material.

TAILWATER. Water below a dam.

TELEMETRY. Use of small radios placed on animals to monitor their movements.

TERRACE. A bench-like structure, usually along both sides of a stream valley (stream terrace).

TERRACE DEPOSITS. Loose alluvial material resting on a terrace.

TOTAL DISSOLVED SOLIDS (TDS). The total quantity (mg/l) of dissolved materials in water.

TRACE ELEMENTS. A chemical element present in minute quantities.

TRANSMISSIVITY. The rate at which water is passed through an aquifer.

TRASH RACKS. Large screens used to prevent debris from being sucked into the penstocks of a dam.

TUFF. A compacted deposit of volcanic ash and dust that may contain up to 50 percent sediments such as sand and clay.

WEATHERING. The breakdown near the surface of rock and soil by physical (such as freezing) and chemical (such as dissolving) processes.

WETLAND. Permanently wet or intermittently flooded areas where the water table (fresh, saline, or brackish) is at, near, or above the soil surface for extended intervals, where hydric wet soil conditions are normally exhibited, and where water depths generally do no exceed 2 meters.

ZOOPLANKTON. Passively floating or weakly swimming minute animal life of a body of water.

LIST OF ABBREVIATIONS

ac. ft.: acre-feet
BLM: Bureau of Land Management
Btu: British thermal unit
cfs: cubic feet per second
cm: centimeter
C: degrees of Centigrade
EIS: Environmental Impact Statement
F: degrees of Fahrenheit
ha: hectare
km: kilometer
km^2: square kilometers
kV: kilovolt
KWH: kilowatt hours
l: liter
MFP: Management Framework Plan
m: meter
mm: millimeter
m^3: cubic meters
mg/l: milligrams per liter
mgd: million gallons per day
MW: megawatt
NOAA: National Oceanic Atmospheric Administration
NEPA: National Environmental Policy Act
ORV: off-road vehicles
T&E: threatened and endangered species
UDWR: Utah Division of Wildlife Resources
USBR: U.S. Bureau of Reclamation
USFWS: U.S. Fish and Wildlife Service
USGS: U.S. Geological Survey
WPRS: Water and Power Resources Service

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